Information Circular 81-1

6th Annual
Review of Activities
of the
Department of Natural Resources
Mineral Resources Division

1981

Hon. J. [illegible]. Bird, Minister of Natural Resources

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NORTHERN NEW BRUNSWICK

J. L. Davies, Regional Geologist

The Bathurst Regional Office is staffed by J. L. Davies, Regional Geologist; J. A. MacIntosh, Assistant Regional Geologist; Sharon McKinnon, Administrative Officer; Maurice Belland, Technician; and André LeBlanc, Technician.

The main activities of the Bathurst Regional Office in 1981 were made possible by funds from the Minerals Sub-agreement.

Northern New Brunswick Metals Project

This project began in 1977. The aim was to gather geoscience data on known sulphide deposits and their environment. It was envisaged that the project could be carried out by graduate students seeking M.Sc. or Ph.D. thesis problems. Phase I, involving the belt of rocks hosting the Restigouche, Murray Brook and Caribou massive sulphide deposits, was carried out by Darrell Rankin. His work is now complete and will be available soon as a Mineral Resources Branch publication.

Phase II comprises two sub-projects (Figure 1): (1) the Nine Mile Brook (NMB) and Flat Landing Brook (FLB) sulphide deposits involving Taras Bryndzia, University of Toronto, and (2) the Stratmat (Cominco) and Heath Steele sulphide deposits involving Leo Owsiacki, University of New Brunswick.

Academic conflicts have affected both these projects. Geological maps (1:5000) covering the Stratmat are now available on open file. A report covering the project is expected by early 1982.

Aeromagnetic Maps

J. J. Chandra and J. W. Wallace have produced 120 Residual and First Derivative aeromagnetic maps covering the Bathurst-Newcastle district. The maps were derived from digitally recorded aeromagnetic data obtained by the Geological Survey of Canada in 1972. This work, also funded through the Northern New Brunswick Metals Project, is described elsewhere in this publication.

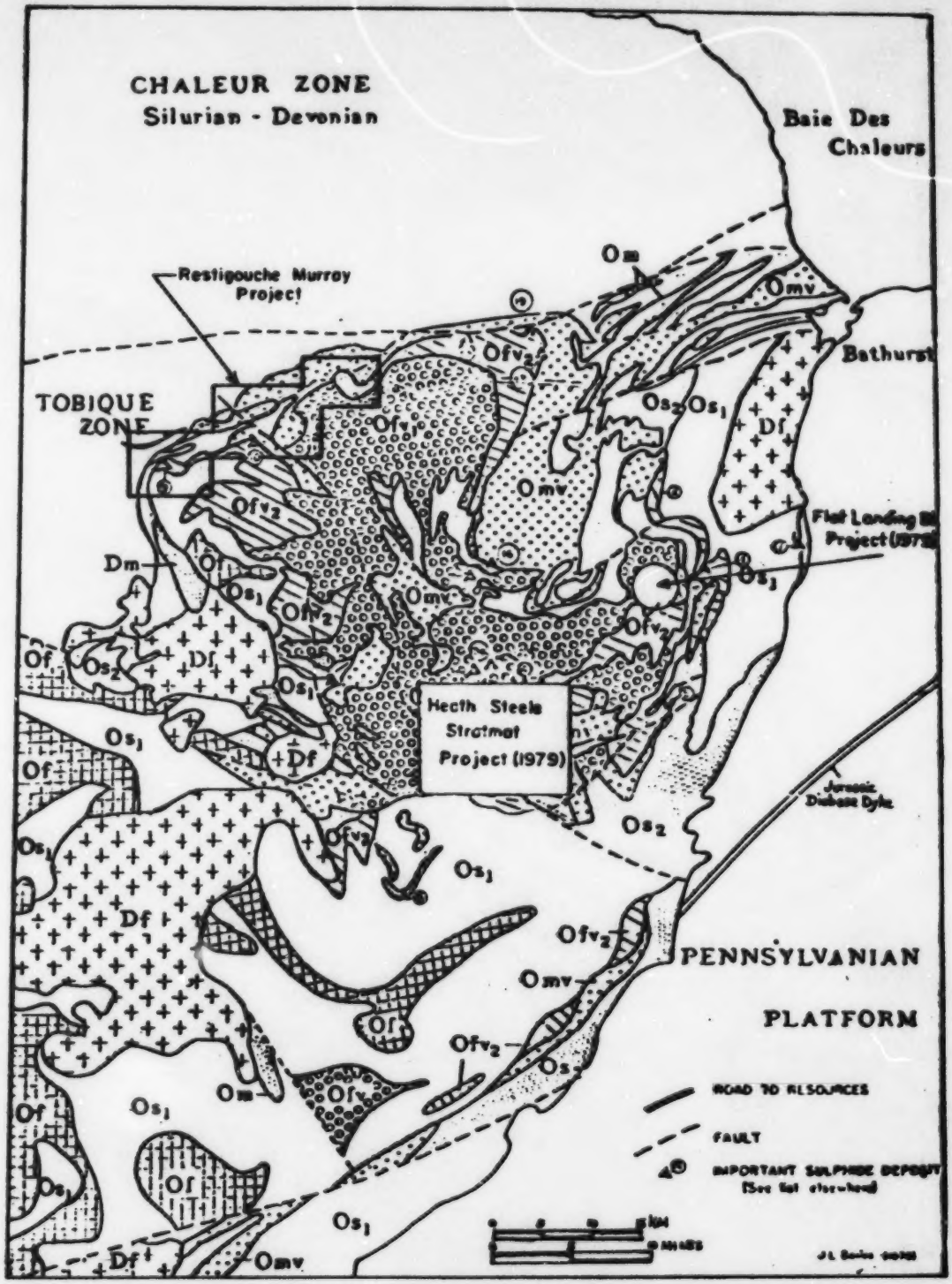


FIGURE 1. GEOLOGY OF THE MIRAMICHI ZONE (NORTH), NEW BRUNSWICK

Intrusive Rocks

Devonian
- granitic rocks
- gabbroic rocks

Ordovician
- metagranite
- metagabbro

Tetagouche Group

Ordovician
- younger metasedimentary unit
- mafic metavolcanic unit
- felsic porphyritic metavolcanic unit
- metarhyolitic rocks
- older metasedimentary rocks

Geological Mapping Map-area 0-9

J. A. MacIntosh continued the geological mapping in the 0-9 map-area, begun by R. H. Morgan in 1979-80. Mr. MacIntosh's report is as follows:

Geological mapping by J. A. MacIntosh is a continuation of that carried out by R. Morgan and L. Davies in 1979 and 1980 (Figure 2). The writer began his mapping on a spot-check basis along bush roads, but discrepancies in lithology as shown on available maps led to a more detailed approach. Nine square miles of the southeast corner of area 0-9 were covered. Figure 3 shows the outcrops examined and the initial interpretation of the lithology.

The northern four fifths of the section is in basic volcanic rocks, limited outcrop size and strong schistosity, generally making the distinction between flows and tuffs difficult. Good to poor pillows and well-bedded, fine-grained sediments and chert were found in several areas. Fine magnetite is present in a large number of the outcrops and may be limited to the sedimentary rocks and tuffs. A small area of what appears to be volcanic, explosive breccia of mixed lithology is outlined provisionally near the centre of the basic volcanic zone.

The southern fifth of the section is underlain by felsic tuffs and crystal tuffs and cherty sedimentary rocks. Magnetite is rare. Relations between these felsic, tuffaceous and the basic volcanic rocks require further study. At present the felsic rocks appear to interfinger abruptly with the basic flows and magnetite-bearing sediments.

Other than apparently minor, gabbroic sills or dikes within the basic volcanic zone, the only intrusive rocks found were three narrow sills of gabbro-diorite in the zone of felsic rocks. The largest of these appears to be a sill of medium-grained meta-gabbro, probably less than 30m (100 feet) thick, near the south limit of the area.

No mineralization of economic interest was discovered. Magnetite was the most widespread and abundant metallic mineral observed and is described above. Pyrite, more widespread than magnetite, was found as frequently in the felsic as in basic volcanic rocks, but only as minor amounts and as single crystals. In a few places it was seen as very fine grained to aphanitic lenses and streaks. Quartz masses about 1 metre

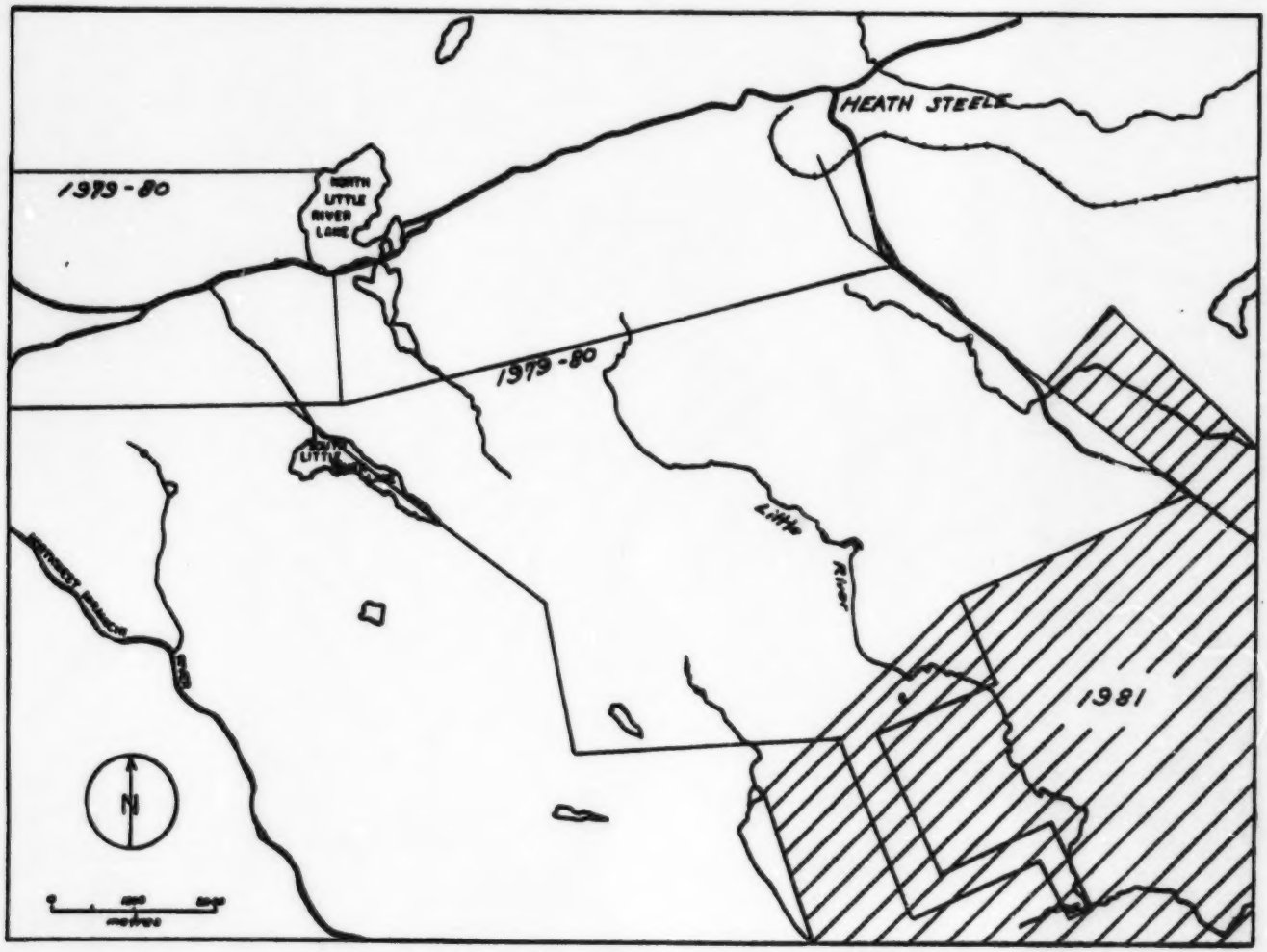
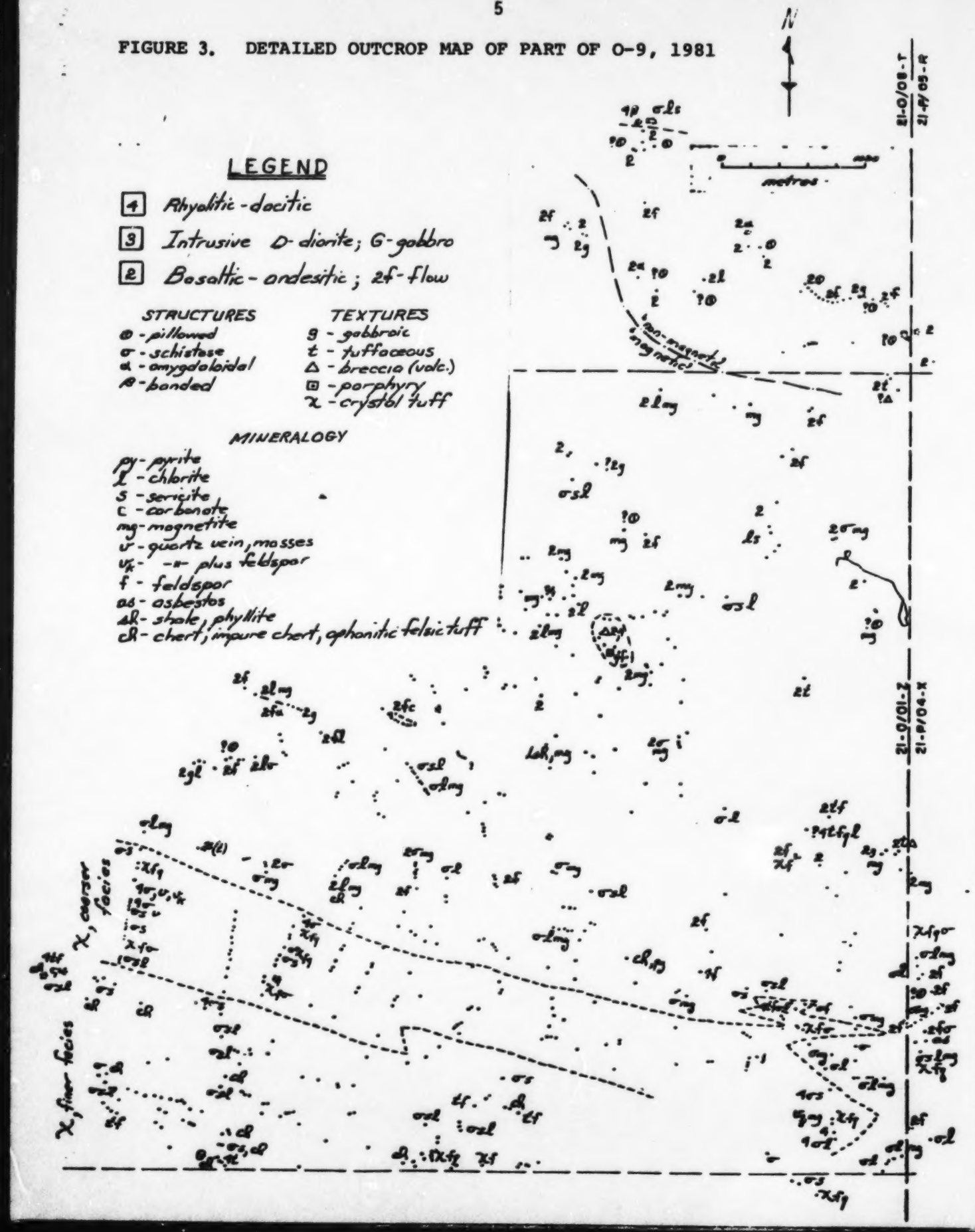


FIGURE 2. AREA MAPPED WITHIN O-9, 1981

FIGURE 3. DETAILED OUTCROP MAP OF PART OF O-9, 1981



(4 feet) across were found, two as float and one in place. No metallic mineralization accompanied the quartz. Asbestos was found as short veinlets, 0.6 cm wide (¼ inch) across, both slip and cross-fibre, in a few outcrops. The occurrence is in what appears to be basic flows, somewhat paler than average for the area, just east of the limit of the area near the southeast corner, north of Little River. Chemical analyses for major and minor elements are to be carried out and may be useful in sub-dividing the basic volcanic unit.

A large volume of structural data was collected, but has not been plotted as yet. Most bedding dips steeply to vertical, except in the northern portion of the basic volcanics where pillows indicate modern dips southeast.

Overburden appears to be relatively shallow over most of the area, perhaps averaging less than five feet. Glacial striae generally trend between 70° and 90°. On the south boundary of the area a large outcrop has glacial striae and channels with numerous indications of smoothing and plucking that indicate that the ice moved from the NE.

Core Storage

Plans are now well advanced for the erection of a permanent prefabricated steel building to be constructed at the Madran Tree Nursery. The new building will have space for 300 to 400 thousand feet of diamond drill core and a small laboratory and office. It is hoped that the building will be ready for use sometime in 1982.

Silurian-Devonian Zone

Interest has been growing in the Silurian-Devonian zone for the last few years. Numerous metallic mineral showings are known but only a few of interesting size have been found. Exploration in the Silurian-Devonian belt has not been intense because it is generally accepted that formation of massive sulphides of the Brunswick type calls for an initial deep submarine environment. The apparently ubiquitous sub-aerial volcanics and shallow marine sediments in the Silurian-Devonian terrane are therefore not encouraging indications. Recent studies, however, in the Irish (Mississippian) base metal deposits, suggest that local rifting in initially

shallow seas, may set up the conditions necessary for the formation of massive sulphide deposits. Such rifting may have taken place in northern New Brunswick late in Silurian and Devonian time. The search for local graben-horst systems may therefore prove profitable.

The writer began a modest program in 1981 to look at the possibilities. The initial work centred around the several showings at Nash Creek, Big Hole Brook and McNair Brook. One of the initial findings was the presence of a large ring structure (caldera?) approximately 64 km in diameter nestled between the Grand Pabos fault on the Gaspé and the Rocky Brook-Millstream fault on the south. Two smaller ring structures appear inside the larger structures. The Zn-Pb-Ag vein sulphide showings occur along the eastern perimeter of the structure although geochemical anomalies and minor showings on the western perimeter have attracted attention in the past (Figure 4).

Geochemistry

Over 3000 geochemical silt samples were collected in the Serpentine Lake (210/2), Sisson (210/6), Kedgwick (210/11) and Upsalquitch Forks (210/10) areas during the past summer. The location is given in the accompanying figure. The results will be available in 1982.

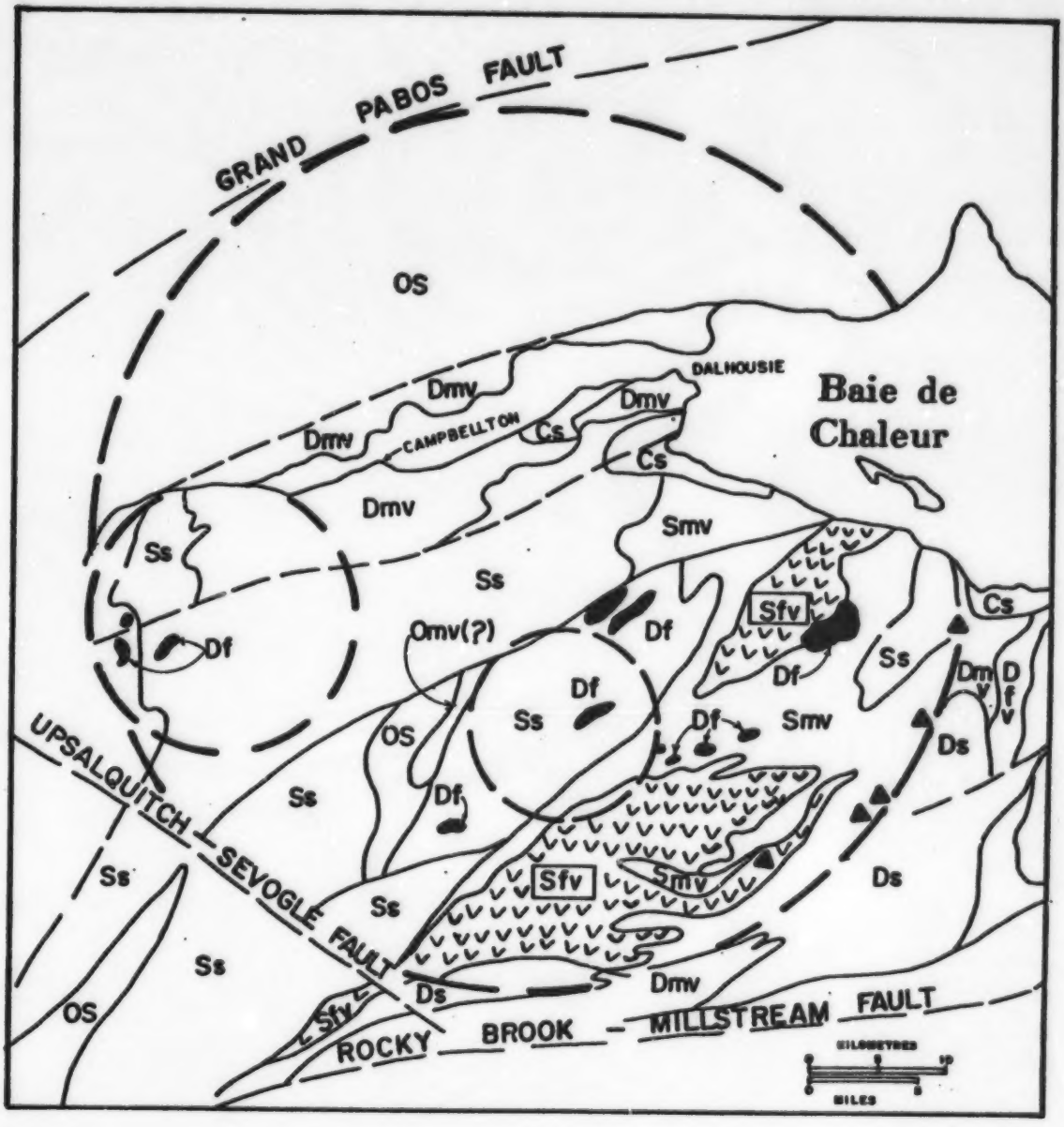


Figure 4—SKETCH SHOWING RING STRUCTURES IN THE SILURIAN-DEVONIAN VOLCANIC TERRANE, NORTHERN NEW BRUNSWICK.

Cs - Carboniferous Df - granitic rocks
Ds - Devonian sediments, Dfv - Devonian felsic volcanics
Dmv - Devonian mafic volcanics; Ss - Silurian sediments
Sfv - Silurian felsic volcanics; Smv - Silurian mafic volcanics
OS - Ordovician-Silurian sediments; Omv - Ordovician mafic volcanics
▲ Zn-Pb-Cu-Ag vein deposit

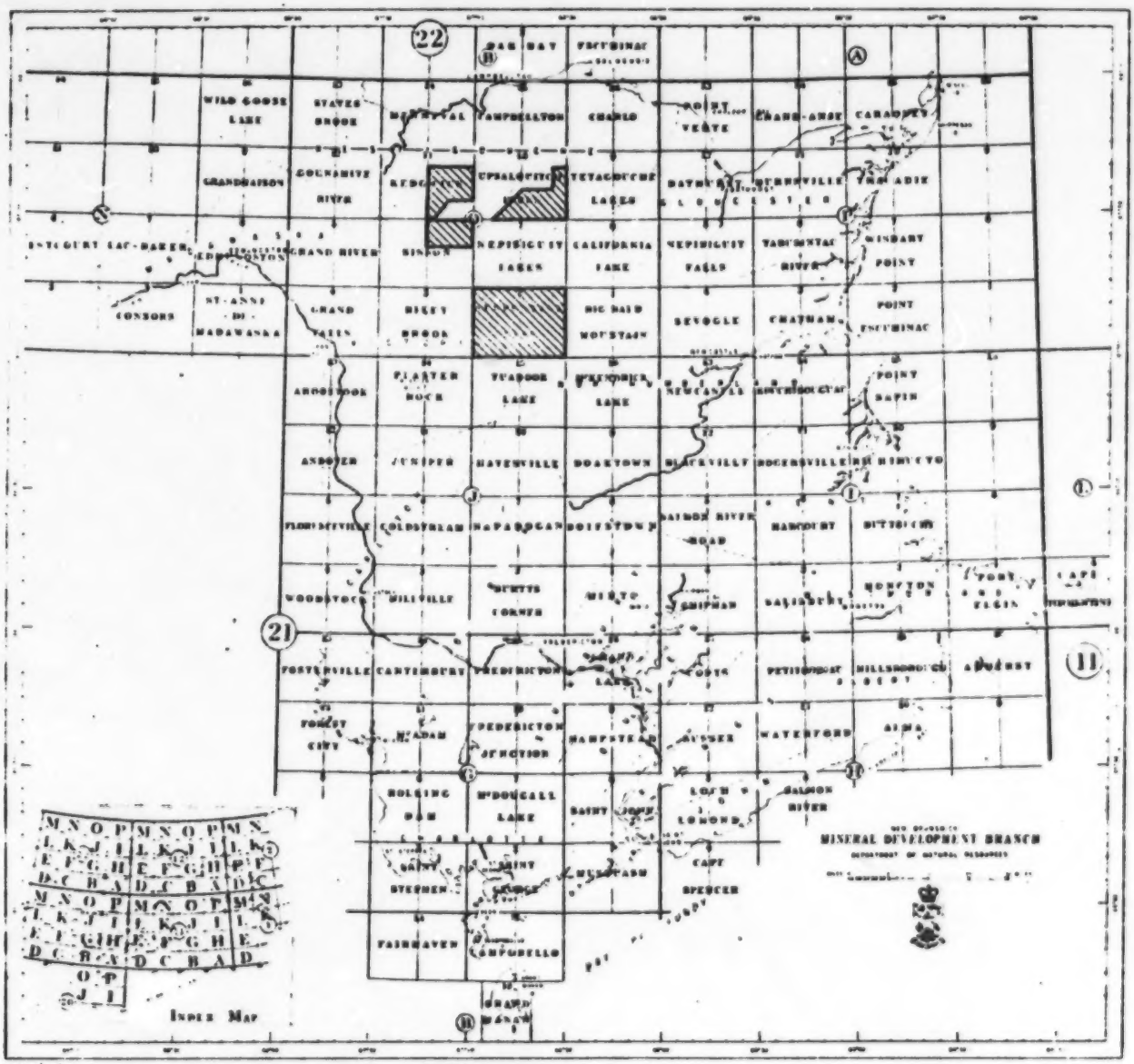


FIGURE 5

GEOCHEMICAL SILT SURVEY 1981

SOUTHERN NEW BRUNSWICK

A. A. Ritenberg, Regional Geologist
S. R. McCutcheon, Assistant Regional Geologist
P. G. Chiswell, Project Geologist

A detailed study of the stratigraphy and paleogeography of the Windsor Group in the Moncton Subbasin was completed.

Geologic maps (scale one inch equals one-quarter mile) of the St. George Batholith were updated by mapping outcrops along numerous newly constructed roads.

A comparative investigation of mineral deposits in granitoid rocks in New Brunswick was completed.

At the request of the Department of Municipal Affairs, the environmental geology of the Sussex-Sussex Corner area was completed and that of the Westfield area was started.

At the request of the Mineral Deposits Division of the Geological Association of Canada, a field trip on antimony-tin-tungsten and uranium deposits in New Brunswick and Nova Scotia was organized.

Consulting and field examination services were provided for numerous exploration geologists and prospectors working in southern New Brunswick. Liaison was maintained with various companies that are developing mines in the southern region. Geologic advice was provided to the New Brunswick Forest Site Classification Council. A display was prepared on the geology of the Sussex area potash deposits. This display was exhibited at a local agricultural fair and in one of the Sussex malls. Talks on New Brunswick geology also were presented at several schools.

Windsor Group Investigation

S. R. McCutcheon completed a Master of Science thesis entitled "The Stratigraphy and Paleogeography of the Windsor Group in Southern New Brunswick", which was submitted at Acadia University, Wolfville, Nova Scotia. It will be reproduced in the near future by the Geological Surveys Branch as Open File Report 81-31. The abstract of this report follows:

"The Lower Viséan Windsor Group in southern New Brunswick (Figure 6) is divisible into six formations and three informal units that have insufficient aerial extent to warrant formation status. The six are: Gays River, Macumber, Parleeville, Upperton, Cassidy Lake and Clover Hill Formations. Two informal units are named: Samp Hill and Demoiselle Creek beds.

The stratigraphic section in the Moncton Subbasin is as follows. The basal limestone consists of shallow-water, basement-fringing, algal buildups (Gays River), in places with intercalated siliciclastics (Parleeville), which are laterally equivalent to deeper-water, very thin to thinly bedded, euxinic limestone (Macumber). The Macumber is overlain by stratiform, nodular to mosaic anhydrite (Upperton) that is hosted by carbonate or calcareous siliciclastics. The sulphate also is equivalent, in part, to the algal buildups. Deep-water salts (Cassidy Lake and Clover Hill) overlie the "basal-anhydrite", have a basin-center distribution, and are capped by greenish grey mudstone ("transitional beds"). Thinly bedded, euxinic limestone with interbedded greenish grey mudstone (Samp Hill) is found between Gays River and "transitional" rocks in the Havelock area only. All these rocks belong to the A subzone of the Windsor Group.

The remaining units (unnamed and Demoiselle Creek) only occur in the Cumberland Subbasin. The uppermost one (Demoiselle Creek) consists of two carbonate subunits separated by red beds and the lower one (unnamed) is composed entirely of red beds. These rocks belong to the B subzone of the Windsor Group, not the C subzone as previously believed.

The lithofacies distribution in the map-area indicates (1) that the Moncton Subbasin was open to the northeast but not the southwest, (2) that the Marysville Subbasin, bordered on three sides by Lower Paleozoic Upland, undoubtedly contains Windsor rocks in the sub-surface probably as far north as the Fredericton Fault, and (3) that the Gays River Formation contains most of the high calcium limestone and all the known base metal sulphide accumulations in the Windsor Group."

The preceding summary pertains to the entire Windsor Group in southern New Brunswick, but because of the current interest in salt and potash, more specific conclusions will be made about them: (1) these

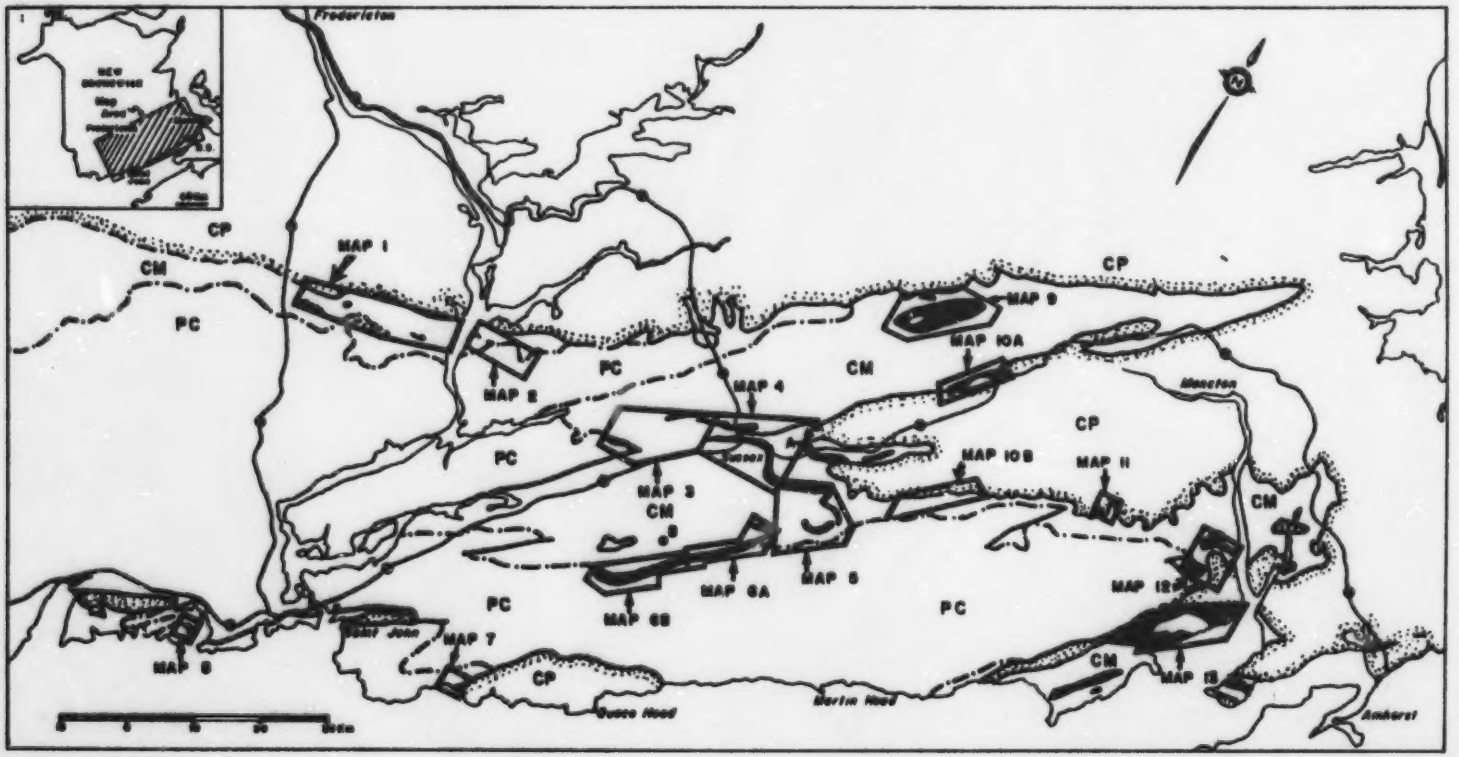


Fig. 6 Location map showing distribution of Windsor Group outcrop (black). A few Windsor rocks also occur at Martin Head and Quaco Head. PC = pre-Carboniferous; CM = Mississippian; CP = Pennsylvanian (dotted pattern to emphasize contact); A = Plumweseep; B = Cassidy Lake

salts are deep-water deposits which are found near the axes of major synclines, originally the deepest parts of syndepositional troughs, (2) they are flanked by and laterally equivalent to sulphate or sulphate-bearing rocks; rapid facies changes are to be expected, (3) they occur in subbasins that were largely enclosed by land areas at the time of deposition. More soluble salts should occur in those parts of the subbasin most removed from the "open" sea.

St. George Batholith Project (Figure 7)

P. G. Chiswell mapped the newly exposed sections along recently constructed roads in the St. George Batholith. This information was used to update existing geologic maps of the batholith.

The batholith comprises a western segment composed of Devonian granitoids (Magaguadavic granodiorite and Utopia granite) and an eastern segment composed of Carboniferous granitic rocks (Lepreau River complex). The present study was confined to the eastern segment, where tungsten occurrences of economic interest have been discovered.

Previous mapping delineated two mappable units in the Lepreau River Complex: the Eagle Mountain and Beek Rock Granites. The Eagle Mountain is a coarse-grained, seriate-porphyritic, biotite granite. The Beek Rock is a red to pink, feldspar-quartz porphyry. Phenocrysts (1-10mm) are embedded in a very fine-grained to aphanitic matrix. Rapakivi textures are common.

Detailed mapping of numerous new outcrops during the summer made it possible to delineate two other phases--the Otter Lake and Mistake Lake granites. The Otter Lake is a white, medium-grained equigranular granite. The Mistake Lake is a buff to brown, porphyritic biotite microgranite that locally has been intensely greisenized. Some of these greisen zones in the Victoria and Mistake Lake areas contain economically interesting amounts of tin and tungsten minerals.

Comparative Investigation of Mineral Deposits in New Brunswick Granitoid Rocks

A. A. Ruitenberg and L. R. Fyffe completed a comparative study of mineral deposits in granitoid rocks and associated subvolcanic intrusions in New Brunswick. Petrochemical analyses were conducted in conjunction

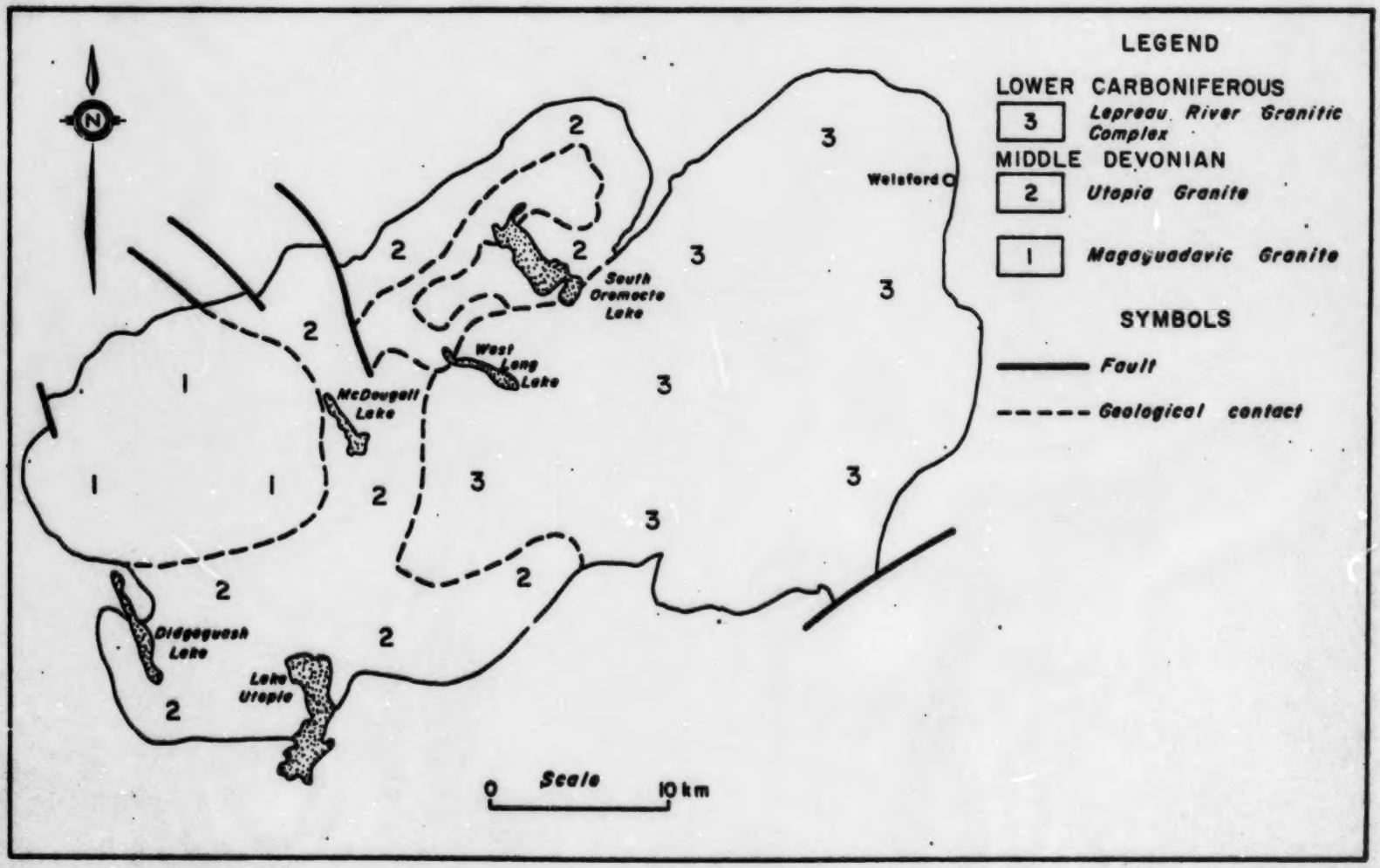


FIGURE 7. ST. GEORGE BATHOLITH PROJECT

with this investigation. The results of the investigation will be submitted for publication to the Canadian Mining and Metallurgical Bulletin.

Several distinct types of metallic mineral deposits related to granitoid or gabbroid intrusions can be distinguished in New Brunswick. Each one of these types appears to be confined to distinct wrench and/or thrust fault blocks, which either coincide with or cut entirely across the tectonostratigraphic zones in the area.

The investigation included:

(a) contact metasomatic base metal sulphide deposits in the Matapedia-Tobique Zone,

(b) base metal sulphide veins in the Miramichi and Magaguadavic-St. Croix Zones,

(c) porphyry-copper $\pm$ molybdenum deposits in the Miramichi and Matapedia-Tobique Zones,

(d) tin-tungsten-molybdenum deposits in greisen and quartz $\pm$ carbonate veins in granite and associated skarns.

The most important conclusions of the investigation are:

1. The tin-tungsten-molybdenum-antimony deposits occur in and along the contacts of the youngest phases of large differentiated batholiths.
2. The tin-tungsten-molybdenum-antimony-bearing intrusions were emplaced in a broad wrench-fault zone that cuts across the southwestern Magaguadavic-St. Croix Zone and into the Central Miramichi Zone.
3. Petrochemical studies of the granitoid rocks indicate
   (a) the tin-tungsten-molybdenum-antimony-bearing intrusions are the final product of a long episode of fractional crystallization. The original magmas that gave rise to these intrusions appear to have resulted mainly from partial melting of sedimentary rocks in areas of thick continental crust (Magaguadavic-St. Croix Zone and part of the Miramichi Zone).
   (b) The contact metasomatic base metal sulphide and porphyry copper deposits are associated mainly with intrusions produced probably from differentiation of mantle-derived mafic magmas. These mantle-derived magmas are particularly abundant in the Matapedia-Tobique Zone--an area interpreted to be underlain by only a thin continental crust. In areas of thicker continental crust, such as along the southeastern margin of the Magaguadavic-St. Croix, mantle-derived magmas are confined to major fault zones.

ENERGY RESOURCES

D. E. Gemmell, Energy Resources Geologist

During the past year, under the energy resources segment, the following projects were carried out (all of which are discussed in more detail in appropriate sections of this report):

(1) Carboniferous Drilling Project:
   (a) Contact mapping and investigation of clays, and
   (b) Geochem. analysis of all chip samples for Cu, Pb, Zn, Fe, Mn, Ag, Co, Ni, Mo, and V.

(2) Peatland Inventory, Counties of Queens, Sunbury and Charlotte.

(3) Geochemistry - preparation of all samples from all sources for uranium analysis.

(4) Coal Beneficiation and Rehabilitation:
   (a) Continuation of project to prepare specs to build a hydro-cyclone coal washing plant with pilot SABA unit, and
   (b) Continuation of project to evaluate the rehabilitation of coal lands disturbed prior to 1967.

(5) Oil Shales:
   (a) Continuation of the investigation of intrastratigraphic relationships in the Albert Formation,
   (b) Oil shale - coal combination pyrolysis in a fluid bed reactor (page 24),
   (c) Continuation of (b) with partial extraction of liquid (page 24) and gaseous hydrocarbons prior to combined burning (page 24), and
   (d) Identification and analyses of lithotypes and carbon typing in conjunction with petroleum geochemistry of New Brunswick's oil shales from existing cores.

(6) General administration with regard to uranium, pipelines and underground storage.

Carboniferous Drilling Project (Dwight Ball)

The project was in a finalization stage with the main thrust being preparation of all chip samples for geochemical analyses. Through work previously carried out, problem areas such as the contact zone mapping segment was augmented to shed light on the interpretation of the final report.

The following publications were made available in the past year:

(1) Report of Investigation No. 18.
(2) Open File Report 80-9 - Geophysical Borehole Logging Calibration Facilities, Fredericton.
(3) Open File Report 80-7 - Stratigraphic Maps as an Aid in the Analysis of the Pictou Group on the New Brunswick Platform and the Moncton Basin.
(4) Open File Report 80-13 - Lithological and Formation Water Sampling.

Also completed was the CARBDRIL computer-based file on all lithologic, geophysical and, to date, geochemical results from the project.

Trout Brook Clay

Trout Brook flows westward into the Northwest Miramichi River, near the Village of Sevogle, about 20 kilometers west-northwest of Newcastle, New Brunswick. Outcrops of Pleistocene varved clay have been found in the bed of Trout Brook from 400 metres to 1400 metres above its mouth. A channel sample of a 4 metre face has been collected for testing from 700 metres upstream of the brook's mouth.

Trout Brook meanders from side to side in a flood plain 100 to 150 metres wide incised into an unevenly-surfaced terrace for the first 1500 metres upstream from its mouth. The terrace has been quarried for sand and gravel on both sides of the brook in its lower 500 metres where it is crossed by New Brunswick Highway 425. Where the meanders meet the southeast edge of the flood plain, outcrops of white to grey, finely-laminated clay are found. These Pleistocene deposits overlie Carboniferous clastic sedimentary rocks at an unknown depth.

The largest of the clay outcrops is 700 metres from the mouth of Trout Brook and presents a cliff face 200 metres long and 4 metres high. The clay layers are flat-lying. This face was channel-sampled on a fresh channel dug into the face across the full 4 metres. The location of this

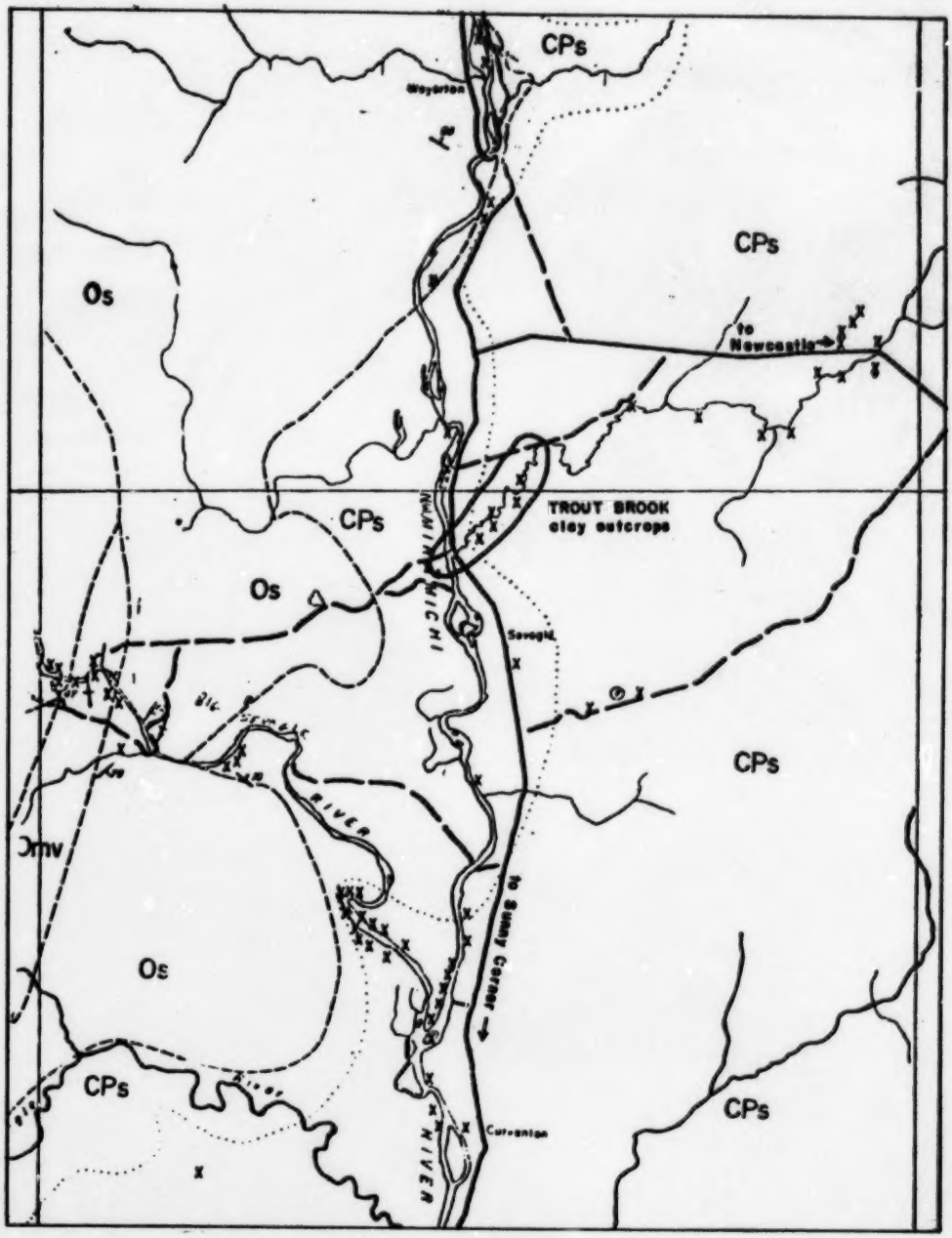


FIGURE 8. TROUT BROOK CLAY

sample is U.T.M. Grid Zone 20T:8524-1970 (Sevogle topographic sheet; 1:50,000; N.T.S. 21P/4).

Other outcrops of clay were observed 400, 750, 1150 and 1400 metres from the mouth of Trout Brook--over a distance of 1000 metres. The lateral extent, depth, and continuity of this deposit was not determined.

Pennsylvanian Contact Mapping Project

The Pennsylvanian Contact Mapping Project is a six-month project which began in June, 1981. Its objective is to determine the nature of the contact of the Pennsylvanian with Mississippian or pre-Carboniferous rocks on the margins of the New Brunswick Platform and Moncton Basin.

Field work conducted between mid-June and the end of September consisted of describing 87 exposures of the lower contact of Pennsylvanian lithologies, either Pictou Group/Clifton Formation (Member B) or intervening Clifton A Member/Boss Point Formation lithologies. These, together with information provided by testholes of the Carboniferous Drilling Project, have provided a tentative division of the nature of the contact between Pictou Group lithologies and Mississippian or pre-Carboniferous basement.

The bottom-most Pennsylvanian lithology is often the dominantly green sandstones, siltstones, and shales of the Clifton Formation or the Pictou Group. These units are similar in lithology and age and have minor lithic, matrix-supported conglomerates with rounded clasts.

In the Moncton Basin, Pictou Group lithologies are separated from Mississippian or pre-Carboniferous rocks by the thick grey and brown sandstones of the Boss Point Formation. This unit has quartz-rich lithic sandstones interlayered with grey, black, and red siltstones and shales. The most distinctive feature of the Boss Point Formation in the field is its high content of coalified and pyritized fossil plants.

In the northernmost margin of the New Brunswick Platform, from the coast to the Little Southwest Miramichi River, Clifton Formation lithologies are separated from the Bathurst Formation's red, poorly-sorted, lithic conglomerates by very pure quartz sandstones and conglomerates of the A Member of the Clifton Formation.

In the central part of the New Brunswick Platform, from the Southwest Miramichi River at Bloomfield Ridge to Dingley Brook near Head

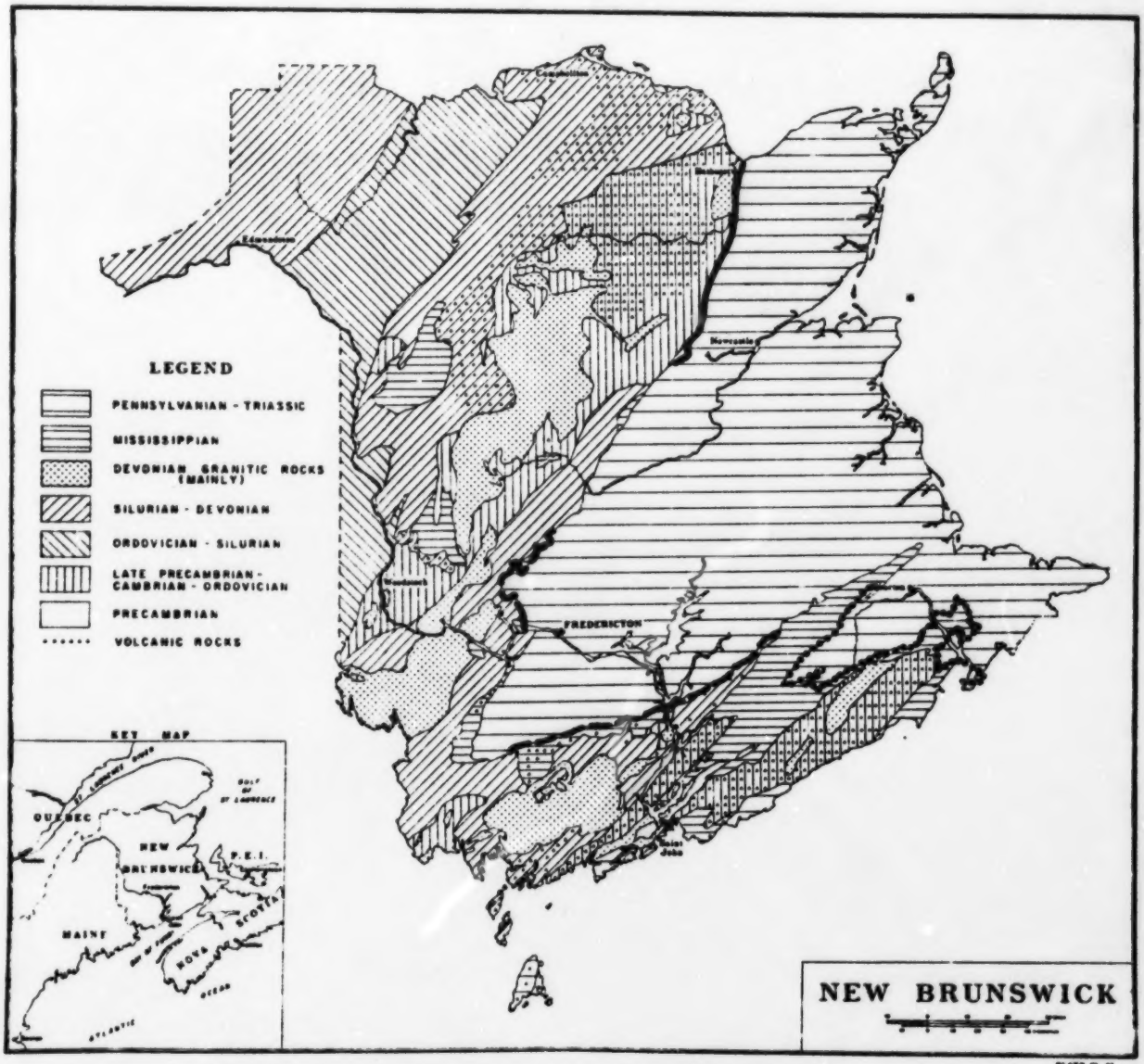


FIGURE 9. PENNSYLVANIAN CONTACT MAPPING PROJECT

———— _ Clifton A Member quartz sandstone

— — — — _ Thin and intermittent quartz pebble conglomerate

•••••••••••••• _ Boss Point Formation

of Millstream, Pictou Group lithologies are separated from pre-Pennsylvanian basement by a thin, intermittent unit of quartz pebble conglomerate in a quartz-rich lithic sandstone matrix.

These three quartz-rich lithologies are distinct mappable units. The remainder of this project is being directed at attempting to determine the relative ages and the relative environments of deposition of these three different rock units.

Peatland Inventory

During the 1981 field season the inventory of the province's peatlands was completed. New Brunswick is the first area in North America to complete such a detailed assessment of the peat and peatland resource. Over 2000 sites on approximately 15,000 hectares were investigated during 1981. Totals for the project are over 21,000 sites on 100,000 hectares. All peatlands greater than 25 hectares have been investigated with the exception of those areas inside National Parks and military bases.

The field methods used are a modification of those used by the Geological Survey of Finland. The procedures used here are currently being followed by Nova Scotia and are being examined by three other provinces. The procedures consist of cutting a grid line and chaining it at 100 metre intervals. At each site a core is recovered and logged according to peat type, decomposition, and other factors. Isopach and elevation maps at 1:10,000 scale are produced for each group of peatlands. Cross-sections displaying peat type and humification are drawn along each line. Computer plotting techniques are used to draw the sections in ink directly on drafting plastic resulting in a substantial manpower saving.

A data storage/retrieval system has been developed. Calculated data can be retrieved at the site level, bog level, and regional level. At the regional level over 600 variables can be used as grouping parameters.

The open file reports produced at the end of each field season are being recompiled on the basis of 1:250,000 N.T.S. map-sheets. A description of each peatland includes numerical data such as the volumes of various peat types, drainage characteristics, and a recommended use. A summary report of the general features of the province's peatlands and the methods used in their inventory is also being prepared.

Of the 85,000 hectares surveyed to the end of 1980, about 52,000 hectares had peat depths exceeding 1 metre. This comprises an "in situ" volume of 1.7 billion cubic metres of peat. About 70 per cent of this is horticultural grade while 30 per cent is fuel grade.

Representative sites on major peatlands were sampled to determine physical and chemical properties for various uses. This information is being compiled and will be included in the final report.

Eighteen peatlands are currently leased to twelve companies for the production of horticultural peat. Numerous other applications have been received and at least two new companies are expected to begin operations in 1982. As well, applications have been received for agricultural utilizations of peatlands. The use of peatlands for development of artificial waterfowl areas by Ducks Unlimited is the largest single user of wetlands in the province. Interest in fuel uses of peat has resulted in a market study of various industrial products including metallurgical coke, activated carbon, carbon raisers, and related products. Follow-up testing of those with highest potential is in progress.

In addition to the open file reports on the annual survey, the following publications relating to the inventory and utilization of the resource are available. While they are not all departmental publications, the inventory information and project personnel were utilized in their preparation.

ANDRE MARSAN & ASSOCIATES INC. 1980. Industrial Uses of Peat of Northeastern New Brunswick. Report submitted to the New Brunswick Department of Commerce and Development, Fredericton, New Brunswick.

GEMMELL, D. E., and KEYS, D. 1979. Evaluation of the New Brunswick Peat Resource. Proceedings of Canadian Peat Symposium, August 1979, Fredericton, New Brunswick. Canadian National Committee of I.P.S., Ottawa.

GEMMELL, D. E., and KEYS, D. 1981. The New Brunswick Peat Resource and its Utilization. In The Geology of Industrial Minerals and Rocks in Canada. CIMM Special Volume.

KEYS, D. 1980. Assessment and Management of the Peatlands in New Brunswick, Canada. Paper presented at Symposium, "Peat as an Energy Alternative", Arlington, Virginia.

KEYS, D. 1981. Peatland Harvesting Methods in New Brunswick. Proceedings of the Organic Soil Mapping and Interpretation Workshop (in press), Fredericton, New Brunswick.

KEYS, D., and FERGUSON, D. 1981. Peatlands Inventory Methods in New Brunswick. Proceedings of the Organic Soil Mapping and Interpretation Workshop (in press), Fredericton, New Brunswick.

KEYS, D., GEMMELL, D. E., and FERGUSON, D. 1981. New Brunswick's Peat Resource Evaluation Program. Proceedings of "A Symposium on Peat" (in press), Thunder Bay, Ontario.

KEYS, D., KLEMETTI, V., and HENDERSON, R. E. 1981. Peatlands of New Brunswick. Proceedings of the Organic Soil Mapping and Interpretation Workshop (in press), Fredericton, New Brunswick.

MONTREAL ENGINEERING COMPANY. 1980. Feasibility Study for a Peat Fired Steam-Electric Power Station with Specific Reference to N-E New Brunswick. Report to Canada Department of Energy, Mines and Resources, Ottawa, Canada.

RESEARCH AND PRODUCTIVITY COUNCIL

Roy S. Boorman, Department Head
Mineral Development and Processing

Approximately 4 per cent of RPC's contract income for this fiscal year 1981/82 will be derived from contracts obtained from the Department of Natural Resources, Mineral Development Branch. This work is funded through a Federal-Provincial Development Project under the Minerals and Fuels Subsidiary Agreement of the Canada-New Brunswick General Development Agreement by the Government of New Brunswick and the Department of Regional Economic Expansion of Canada.

Although the contribution from this source is small, the two sponsored R & D projects, coal/oil shale fluid-bed combustion and the RPC SRL Process are both challenging and rewarding to us as scientists and engineers. We feel that both of these projects have significant possible benefits to the Province of New Brunswick.

1. Coal/Oil Shale Combustion

At the request of Mr. Don Gemmell, Department of Natural Resources, RPC has begun a program aimed at utilization of New Brunswick's sulphur-rich, high-ash coal in combination with Albert County oil shale, the object being to extract energy from the shale and coal whilst the spent shale serves as a captive media for sulphur dioxide. Such a system, properly engineered, could result in an increased New Brunswick energy reserve base, either as fuel for coal/oil shale fired thermal plants with relatively low SO_2 emission, or for a combination, low sulphur emitting power station plus oil refinery.

Combustion tests on 26 gal/ton Albert County oil shale and Minto coal have been undertaken in a bench scale rotary tube furnace and a six-inch fluid-bed reactor to determine maximum sulphur capture and fluidization characteristics. Rotary furnace trials have shown that oil shale is effective in fixing SO_2 with a maximum utilization of 70 to 79 per cent of the available carbonate. This would give an approximate ratio of oil shale required to fix the sulphur dioxide generated from coal combustion of three parts oil shale to one part coal.

Fluid-bed trials on SO_2 capture have indicated even higher fixation ratios and thus lower oil shale/coal ratios (<3:1) may be possible. Twenty-five gal/ton oil shale in itself gave excellent fluidization characteristics, and produced excess heat over that required to sustain the reactor at 800°C. Cooling water was required to maintain temperature.

Preliminary oil shale/coal blend (3:1) combustion trials were carried out in the six-inch reactor. Fluidization was excellent, with dust carryover minimal. Fluidization was enhanced by the coal reaction product of porous pellets consisting mainly of ash. Sulphur dioxide was not detected in the off gas, indicating that oil shale/coal ratios lower than what were achieved in the rotary furnace are possible.

Additional trials are now underway to obtain optimum data upon which we will be able to develop possible engineering concepts and preliminary plant economics.

2. RPC SRL Process

In February of this year RPC and the engineering firm, SNC of Montreal, completed a preliminary capital and operating cost estimate for a 25 TPD pilot plant to process bulk concentrates from New Brunswick base metal operations. Total capital cost for the plant will approximate 16 million dollars to be expended in three stages. Completion of the first stage, at under 8 million dollars, should be sufficient to define commercial risk.

Three mining companies have participated thus far in an advisory capacity to the Province. The technology has been judged sound by these and other companies and the province is presently attempting to put together a piloting consortium. RPC is continuing to work with individual clients on company-sponsored test programs and we are optimistic that out of this effort will emerge the correct mix of participation sought for this project.

BEDROCK MAPPING - WEST CENTRAL NEW BRUNSWICK

Lee Fyffe

Geological mapping during the summer of 1981 was carried out on a 1:50,000 scale in western New Brunswick (Figure 10). The following areas were covered:

Aroostook-Plaster Rock (G-12, H-12, G-13, H-13, G-14N) by G. Crouse
Andover (G-15, H-15E, G-16, H-16E, G-14S) by R. Irrinki
Florenceville (G-17, H-17, G-18, H-18, G-19) by C. St. Peter
Juniper (I-15, H-15E, H-16E) by J. Charuk and J. Aylward

The western part of the mapped area is underlain mainly by Upper Ordovician to Lower Silurian limestone of the Matapedia Group. An inlier within the limestone in the Listerville-Beaconsfield area consists of quartzite and slate that can be traced to the Mars Hill area of Maine. The Matapedia limestone is overlain conformably by Silurian ferromanganiferous slates and quartzose turbidites near Woodstock and by volcanics near New Denmark. In the east near Coldstream, Silurian conglomerate and limestone sit unconformably on several small inliers of Lower Ordovician limestone and chert. The Silurian rocks are overlain conformably by Devonian sandstone, slate, conglomerate, and volcanic rocks. Carboniferous conglomerate and sandstone unconformably overlie the Devonian rocks.

Several northeasterly trending faults cross the area and have displaced rocks as young as Carboniferous. The sense of movement is largely right-lateral with a local component of thrusting to the southeast.

A 1:250,000 compilation map of 21J (Figure 11) has been prepared from the above 1:50,000 maps and from the 1:15,840 maps previously covered by the project over the past five years. A coloured version of the 1:250,000 map will be published shortly.

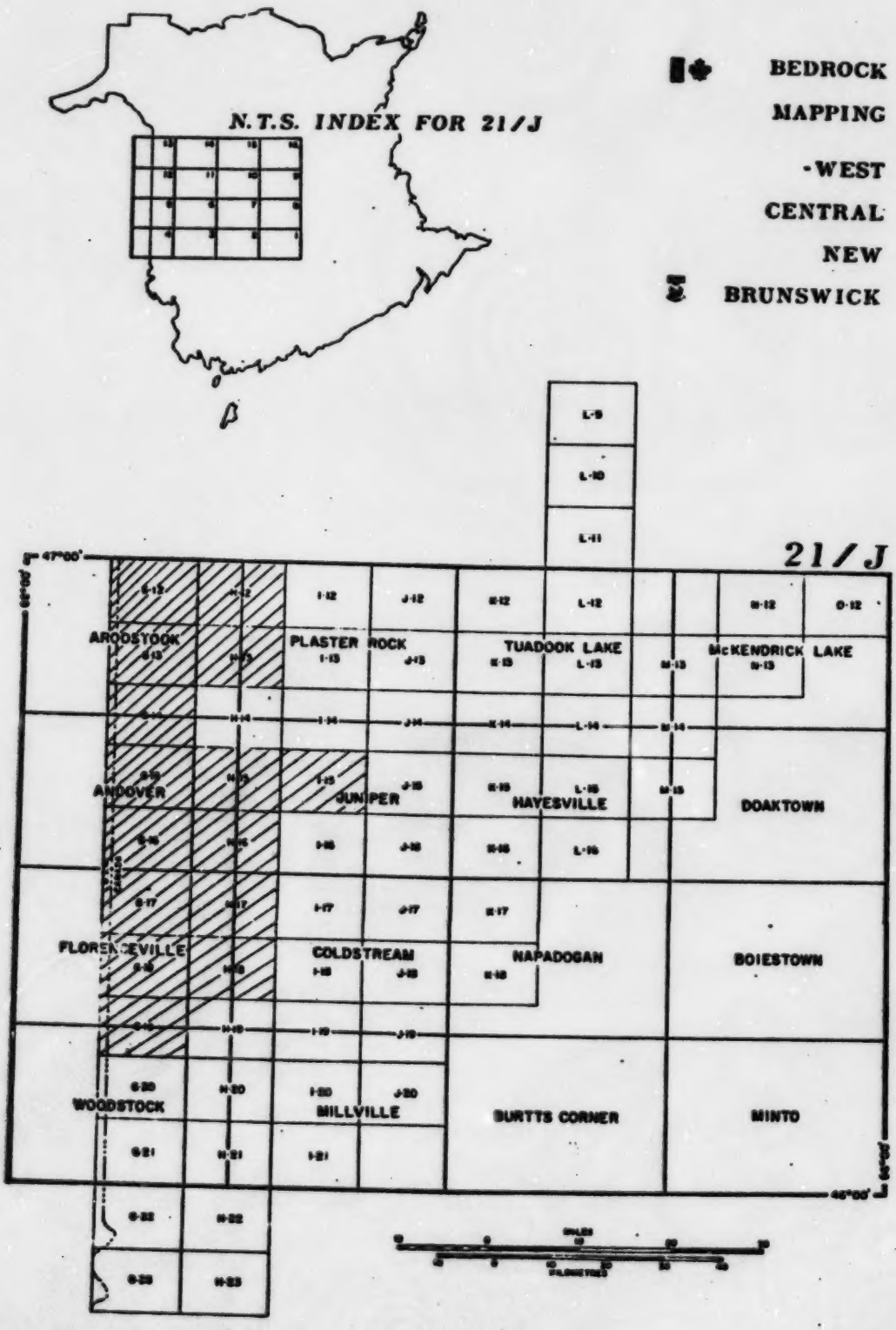


FIGURE 10. BEDROCK MAPPING - WEST CENTRAL NEW BRUNSWICK

LOWER JURASSIC

Jm — Dark grey, subophitic theleiitic diabase

PENNSYLVANIAN

P_{e5} — Grey to olive green sandstone and conglomerate; minor green and red siltstone, shale, and sandstone

P_{e4} — Red and green sandstone, conglomerate, and shale

P_{e3} — Grey sandstone, shale, and conglomerate; coal

P_{e2} — Red conglomerate and sandstone

P_{e1} — White and grey quartz-pebble conglomerate and sandstone

MISSISSIPPIAN and/or PENNSYLVANIAN

MP_{es} — Red and green shale, nodular limestone, gypsiferous shale, and gypsum

MPt — Buff, green, and red mottled felsic tuff interbedded with siltstone, sandstone, and conglomerate

MPbv — Greyish black, amygdaloidal, plagioclase-phyric basalt locally containing analcime; minor olivine-phyric basalt

MP_{cs} — Red sandstone, conglomerate, and breccia; minor red siltstone, shale, and mudstone; minor buff to grey calcareous, quartz-pebble conglomerate and sandstone

UPPER DEVONIAN or LOWER MISSISSIPPIAN

DMf — Pink to red, coarse- to medium-grained, equigranular to subporphyritic biotite granite varying to quartz-feldspar porphyry; minor quartz-feldspar porphyry dykes, pegmatite, aplite and greisen

LOWER to MIDDLE DEVONIAN

Df_4 — Pink to grey, medium-grained, equigranular muscovite-biotite granite; minor garnet- tourmaline- and beryl-bearing granite and pegmatite

Df_3 — Pink to grey, medium-grained, equigranular to megacrystic biotite granite locally varying to hornblende-biotite granite and granodiorite

Df_2 — Grey to pink, medium-grained, equigranular to subporphyritic, foliated, biotite and hornblende-biotite granodiorite and tonalite; minor pegmatite

Df_1 — Grey to pink, fine- to medium-grained, micrographic, biotite and hornblende-biotite granite and granodiorite; minor reddish-brown quartz-feldspar porphyry and red granophyre

Dm — Green to grey, medium-grained, subophitic to ophitic gabbro

LOWER DEVONIAN

Tobique Group

Dmv — Green and grey amygdaloidal mafic volcanic rocks; minor hyaloclastic tuff and pillow basalt (interbedded in part with Unit Du)

Dfv — Buff to pink quartz-feldspar porphyry, grey to pink ostanitic ash flow tuff, lapilli tuff, orange flow-banded rhyolite, and purplish grey aphanitic rhyolite (interbedded in part with Unit Du)

Du — Grey lithic sandstone, quartzose sandstone, siltstone, slate, and polymictic conglomerate

SILURIAN

Ringoclear Group

Sc_3 — Green and maroon greywacke and slate

Sc_2 — Grey quartzose greywacke, grey lithic greywacke, grey slate, black pyritiferous slate, and minor grey calcareous slate

Durham Group

Sfv — Pink, amygdaloidal, felsic volcanic rocks

Smv — Green, amygdaloidal, mafic volcanic rocks

Sc_1 — Grey slightly calcareous quartzose sandstone, green and grey calcareous sandstone, siltstone, and slate; red to maroon ferromanganiferous siltstone and slate; minor green nodular siltstone, grey laminated graptolitic siltstone, grey crystalline limestone, grey polymictic conglomerate, and grey lithic greywacke

UPPER ORDOVICIAN to LOWER SILURIAN

Matapedia Group

OSs — Thinly and regularly interbedded grey calcareous slate, grey to black aphanitic limestone, and grey finely crystalline limestone

ORDOVICIAN (may in part be older)

Of — Pink, fine- to medium-grained, foliated, equigranular to megacrystic granite

Gb — Green, medium-grained, schistose gabbro

LOWER to MIDDLE ORDOVICIAN

Tetagouche Group (upper part)

Og_3 — Lithic greywacke, grey siltstone, and slate; minor grey calcareous siltstone and maroon slate

Omv — Green, amygdaloidal, porphyritic, and locally pillowed mafic volcanic rocks

Ofv — Buff to grey aphanitic rhyolite, porphyritic rhyolite, and crystal tuff (interbedded in part with Unit Og_2)

Og_2 — Green and maroon ferromanganiferous slate and chert, grey to black graphitic slate and chert; minor green and grey greywacke; minor felsic and mafic tuff

Og_1 — Grey crystalline limestone interbedded with black chert; minor grey greywacke, quartzite, and felsic tuff

CAMBRIAN to ORDOVICIAN

Tetagouche Group (lower part)

COg — Olive green to grey quartzose greywacke interbedded with green, grey and maroon slate and siltstone; minor grey calcareous siltstone and green quartzite-pebble conglomerate

Migmatite Complex (may in part be older)

Cmp — Interlayered grey cordierite-bearing quartzofeldspathic paragneiss and sillimanite-bearing schist; grading to grey medium-grained, nebulitic granitoid; minor green- and grey-banded, fine-grained amphibolite

XX — Axial trace of folds (syncline, anticline)

Fault

Mineral deposits; stratiform, vein, non-metallic

Source material: N.B. Mineral Resources Map Reports 77-1, 79-4, 81-5, 81-8, and N.T.S. 21J/13 by G. Crosson; 78-2, 79-1, 80-2, 81-7, and N.T.S. 21 J/12 by R. Irrinki; 79-3, and 81-4 by G. Lajoie; 78-1, 79-3, 80-1, , and N.T.S. 21J/5 by C. St. Peter; 78-3, 79-5, and 81-6 by D. Venugopal; N.B. Mines Branch Report No. 2 by J. Hamilton; N.B. Mineral Development Branch, Report of Investigations No. 15 by T. Hamilton-Smith; G.S.C. Paper 69-12 and Memoir 353 by F. Anderson; G.S.C. Memoir 190 by J. Caley; G.S.C. Memoir 260 by J. Muller; G.S.C. Map 6-1963, Map 7-1957, Map 11-1958, and Paper 68-15 by W. Poole; G.S.C. Paper 74-33 by N. Skinner; U.S.G.S. Bulletin 1264 by L. Pavlides

Compiled by L.R. Fyffe 1982

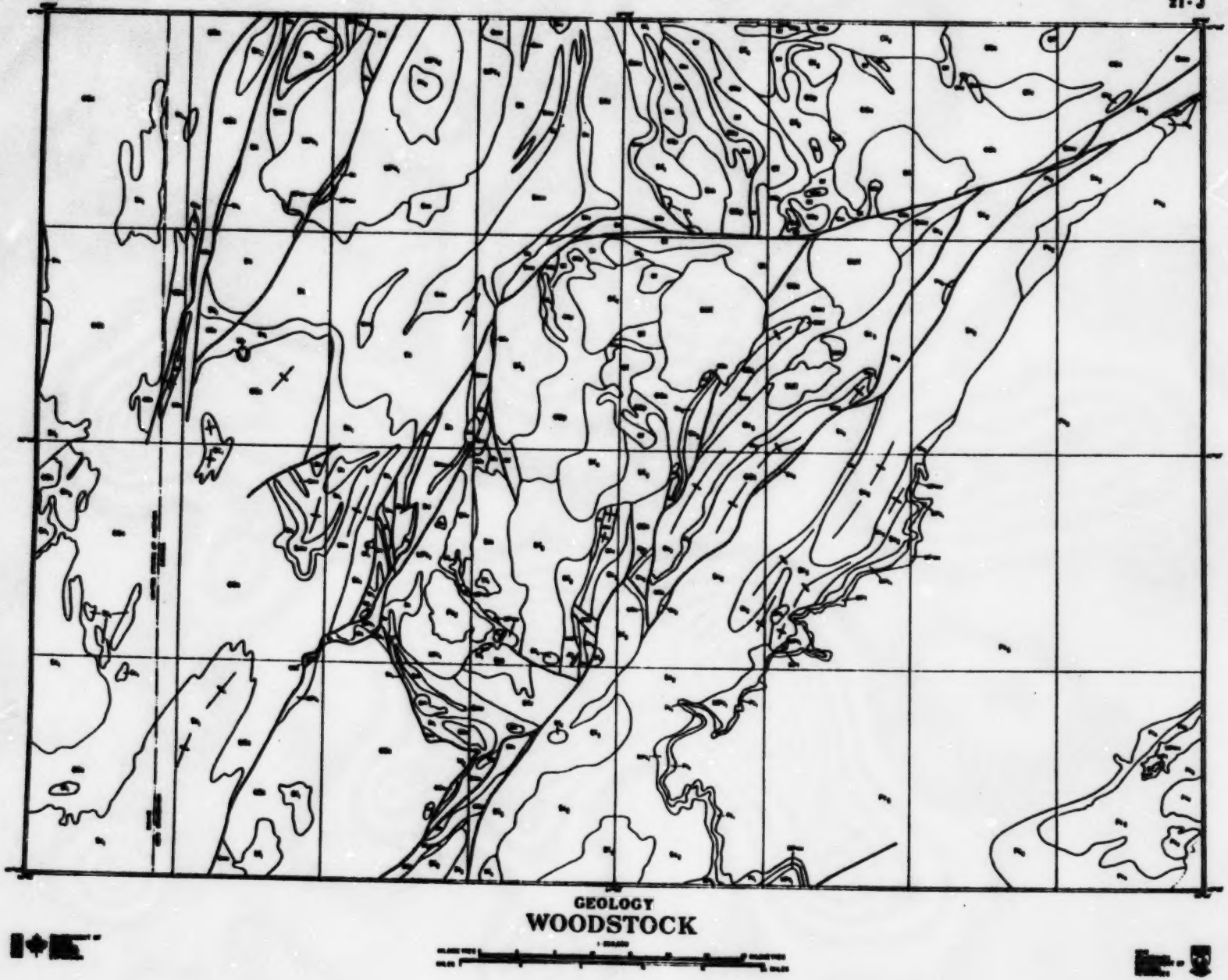


FIGURE 11

GEOPHYSICS

J. J. Chandra

General

Consulting services were provided to several exploration and mining companies, local prospectors and engineering contractors active in the area. Field assistance was rendered when necessary. Services were also provided to various Branch geologists. Analysis of airborne geophysical data was done in preparation for geologic mapping. Assistance in the final analysis of geologic and geophysical data was also given.

Detailed Work

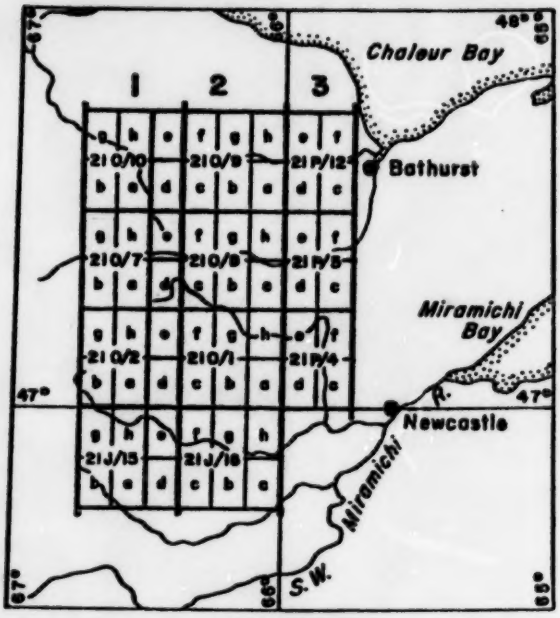
Gravity

A modelling study of the Dorchester gravity low was completed and published in "Request for Tenders for the Right to Explore and Develop a Salt-Potash Prospect in the Dorchester Area". Similar studies are underway for gravity anomalies located at Smithtown-Salina, Pollett River, River Glade, Middlesex, Salisbury and Moncton-Dieppe. These anomalous areas were outlined by gravity surveys carried out by D. A. Williams (D.N.R.) in 1979-80.

Because of rough topography in several of these areas, terrain corrections have to be made to the Bouguer values before the gravity data can be assessed. Applying this correction is a very tedious job and requires considerable time and effort. For this reason, publication of data for these areas is not anticipated until March, 1982. Work to date on these anomalies is on display. Methods of analysis are also on display for interested parties.

Aeromagnetics

The "Dalhousie-Bathurst", better termed "Bathurst-Newcastle", aeromagnetic survey flown by the G.S.C. in 1972, covered approximately 8000 km^2 in Gloucester, Restigouche and Northumberland Counties, New Brunswick (Figures 12 and 13). The original survey results were published jointly by the G.S.C. and N.B.D.N.R. in 1975 as 60 "Total Field" aeromagnetic maps



INDEX MAP

Scale: 1:2,000,000

Block 1 flown at 3000' ASL
Block 2 flown at 2500' ASL
Block 3 flown at 1500' ASL

FIGURE 12. Index to Bathurst-Newcastle Aeromagnetic Survey.

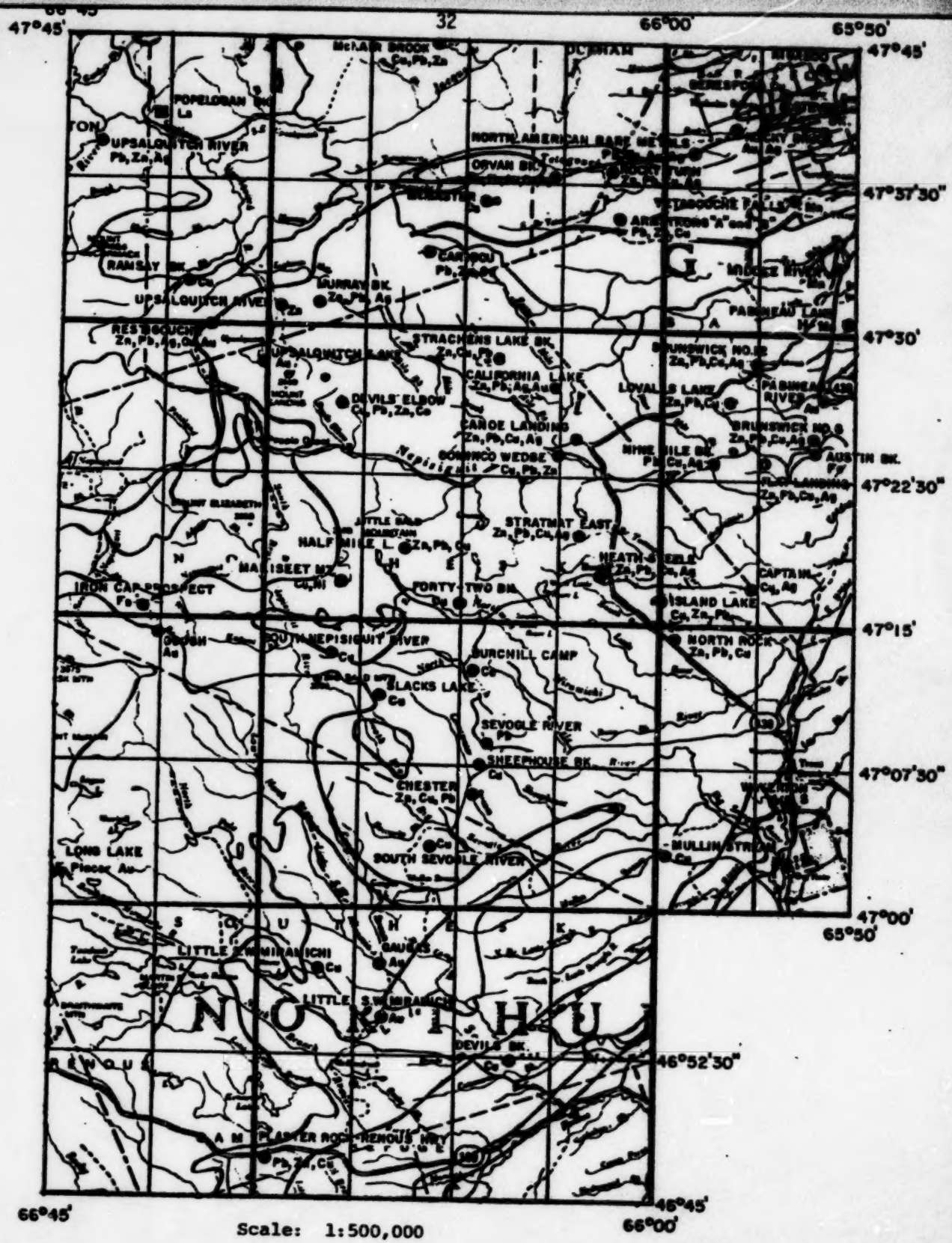


Figure 13. Area covered by survey showing major mineral occurrences (after Carroll, 1978). For map numbers, see Figure 12.

at a scale of 1:25,000.

In 1976, P. H. McGrath (G.S.C.) prepared several Residual and 1st Derivative maps from the 1972 data. Because of the interest shown in these maps by exploration companies, the Geological Surveys Branch (N. B.) undertook the completion of the project with the assistance of P. H. McGrath.

The method of compilation was derived from McGrath (1975) and McGrath et al. (1976). Residual and 1st Derivative magnetic data were compiled for each of the original 60 maps at a scale of 1:20,000 (i.e. 120 maps in all).

It is anticipated that these maps will be released for publication by November 30, 1981 (samples are on display).

GEOSCIENTIFIC AND INFORMATION SERVICES

Donald J. J. Carroll

During the past year, various activities were carried out that resulted in the promotion of the mining industry and the mineral resources of the province. In addition, a program to provide easier access to geoscientific data contained within the files of the Mineral Resources Division was also continued.

A brief summary of these activities is as follows:

Microfilming of Geoscientific Data

To date approximately 98 per cent of the 1980 mineral exploration assessment file reports have been microfilmed and are available for viewing in the microfiche format. In addition to those microfiche sets located in our two regional offices at Sussex and Bathurst, we have also deposited complete sets along with an appropriate microform reader in libraries in Edmundston, Campbellton, Bathurst, Moncton, Saint John and Fredericton for the benefit of those users who are unable to visit our offices during normal office hours.

To provide assistance to those users who require paper copies of some of these reports, we have installed at both our regional offices a Xerox 740 microform printer which is capable of producing 8½ x 11 inch paper copies from the microfiche.

In addition to the assessment file reports, we are also microfilming our transparent map plates as a complement to our microfiche data file. It is the intention of our Branch to complete this work by fiscal year end, March 31.

In response to a favourable reply to a questionnaire sent out to those on our mailing list concerning the market for purchases of duplicate copies of our microfiche geoscientific data, the Mineral Resources Division is presently seeking to facilitate the production of these duplicates.

Public Awareness Program

During the past summer, four students were hired to promote the mining industry and mineral resources of New Brunswick. Their touring

exhibit which consisted of a panel display and slide program was set up in malls in Fredericton, Edmundston, Campbellton, Bathurst, Douglastown, Moncton and Saint John.

To attract the public to the display, local, provincial and federal dignitaries, along with media interviews and photos, were widely used throughout the campaign. In addition, at each centre prizes consisting of rock and mineral kits were given to children and, at the end of the summer, three adult prizes consisting of a coal bear, copper pan and pewter goblets, donated respectively by Triple L Industries, Brunswick Mining and Smelting Corp. Ltd., and Consolidated Durham Mines and Resources, were drawn.

At each of the exhibit centres, the students were on hand to distribute literature on mining and the province's mineral resources, including the newly completed New Brunswick mineral heritage brochure, and to answer basic questions on the industry or refer their request to the appropriate sources for additional detail.

Prospecting Course

The New Brunswick Department of Natural Resources, in co-operation with the University of New Brunswick Geology Department and Extension Services, initiated a prospecting course early in 1981.

The six-session course which was offered in Moncton, Sussex, St. Stephen and Woodstock, was conducted by W. Lockhart.

Due to the abundance of applications to take the course, and the limited enrollment in this year's course, the Mineral Resources Division is presently evaluating the program with a view to re-offering the course this year and possibly extending it to the northern part of the province.

INDUSTRIAL MINERAL RESOURCES

Donald E. Barnett, Industrial Minerals Geologist

Aggregate Resources

The objective of this program is to map granular aggregate resources in the McAdam, St. Stephen, Canterbury, Plaster Rock, Juniper, Newcastle and Doaktown regions (Figure 14) and thereby continue the inventory of these resources for future use. Mapping is at the 1:50,000 scale.

The work was carried out partly by "in house" geological staff and partly by contract to Geocon Inc., consultants of Fredericton. The mapping program was divided into six map-areas:

(i) McAdam (21G/11) and Forest City (21G/12)

(ii) St. Stephen (21G/3) and Rollingdam (21G/6)

(iii) Riley Brook (21O/3), Plaster Rock (21J/14) and Tuadook Lake (21J/15)

(iv) Juniper (21J/11), Hayesville (21J/10), Coldstream (21J/6) and Napadogan (21J/7)

(v) McKendrick Lake (21J/16), Newcastle (21J/9) and Doaktown (21I/13)

(vi) Canterbury (21G/14) and Fosterville (21G/13).

Areas (i) and (ii) were mapped by "in house" geological staff and preliminary reports follow. Areas (iv) to (vi) were mapped under contract to Geocon Inc. and results will not be available until January, 1982.

McAdam (21G/11) and Forest City (21G/12) Map-areas (Allen Seaman)

The granular aggregate resources of the McAdam (21G/11) and Forest City (21G/12) map-areas are outlined in Figure 15. The bulk of the aggregate resources of reasonably good quality are found in ice-contact and outwash deposits associated with the Magaguadavic River system. A much smaller volume of material, primarily of ice-contact origin, is found in association with the St. Croix River system.

Reserve volume and quality estimates are as follows:

Magaguadavic River - 15+ million m^3 of poor to good, fine and coarse

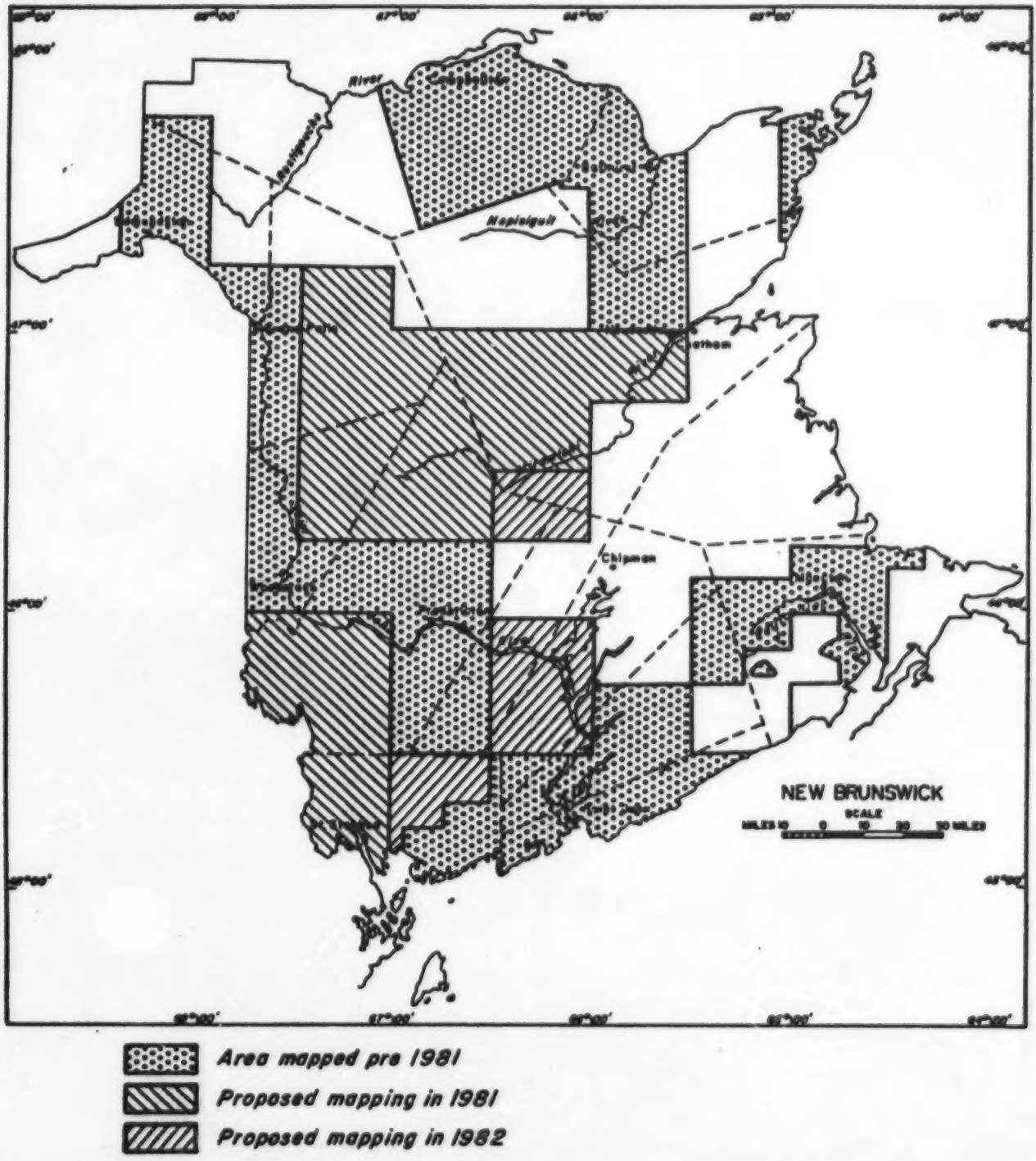


Figure 14. Granular Resource Mapping in New Brunswick, 1981

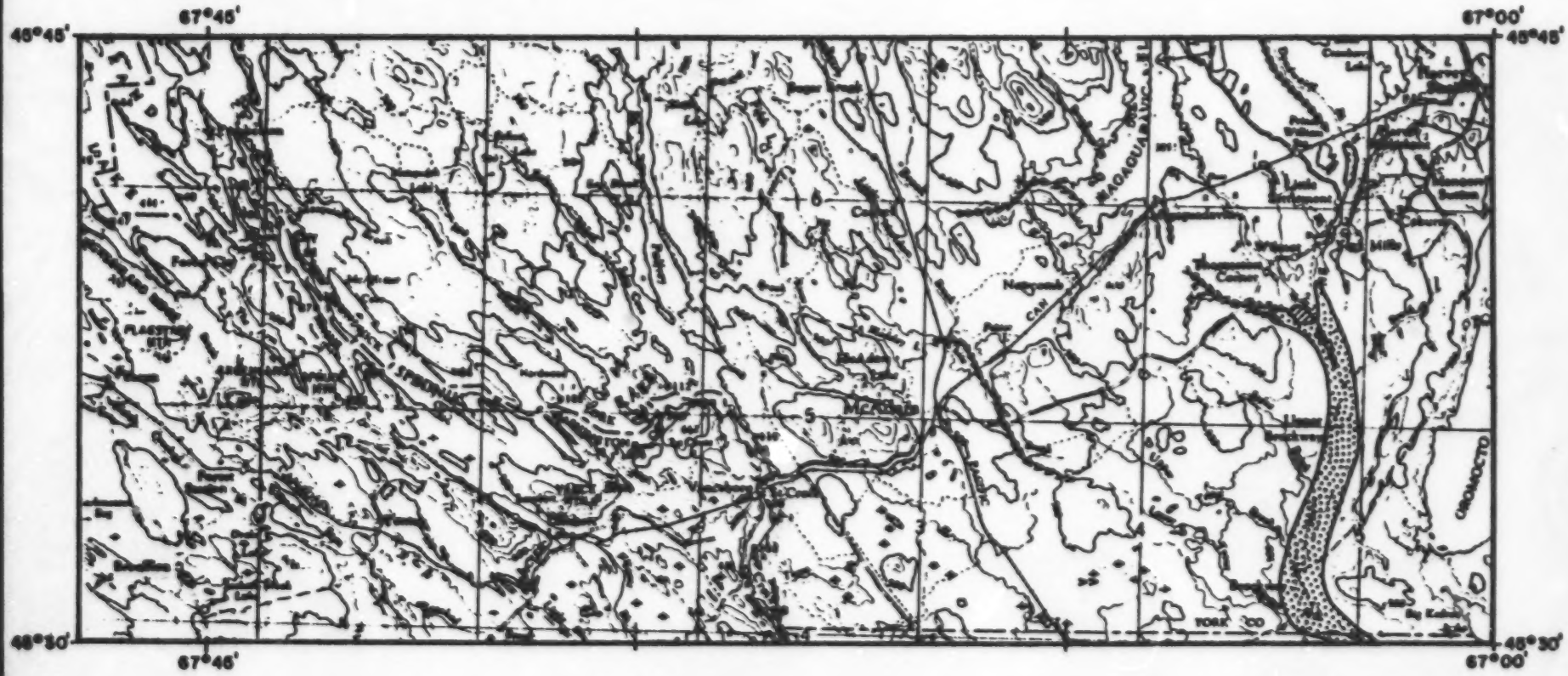


FIGURE 15.

AGGREGATE RESOURCES, McADAM AND FOREST CITY

21 G/11,12

aggregate are present in the Magaguadavic valley south of the junction with the Northeast Magaguadavic River. The ice-contact deposits are generally composed of poor to fair quality sand and gravel; the outwash deposits are predominantly sand, but with some fair to good sand and gravel;

Northeast Magaguadavic River-Deadwater Brook - 2.5+ million m^3 of fair to good sand and gravel are present in esker and outwash deposits;

Magaguadavic-Davis Brook - 1.5+ million m^3 of sand and fair to good sand and gravel are present in this esker system;

East side of Magaguadavic Lake - 200,000+ m^3, predominantly sand;

Cranberry Brook - 150,000+ m^3 of sand and fair to good sand and gravel. The esker to the north, along Duck Brook, probably consists of similar material, in the order of 20,000 m^3.

White Beaver Brook - 300,000+ m^3, predominantly sand, but with some fair to good sand and gravel. The tiny esker to the south comprises approximately 15,000 m^3 of fair sand and gravel;

St. Croix River - 700,000+ m^3 of sand and fair to good sand and gravel are present in the esker south of St. Croix;

Palfrey Stream-Dead Brook (West) - 100,000+ m^3, predominantly sand, but with some poor to good sand and gravel;

Sixth Lake - 400,000+ m^3 of sand and poor to good sand and gravel are associated with this ice-contact complex;

Forest City - 150,000+ m^3 of material is associated with four small deposits within this map-area--the two eskers consisting primarily of sand, the two outwash deposits of fair sand and gravel.

In addition to the aforementioned deposits, a large volume of very low-grade material is found in ablation till deposits (not on map), which are scattered throughout the two map-areas. This material is frequently silty, and often extremely bouldery, but has been used locally as fill for logging roads. The high boulder content of this material, and of some of the basal tills, could be of potential use as a source of riprap.

St. Stephen (21G/3) and Rollingdam (21G/6) map-areas (Jacques Thibault)

The main source of granular aggregate is found within ice-contact systems, mainly eskers. There are three major systems:

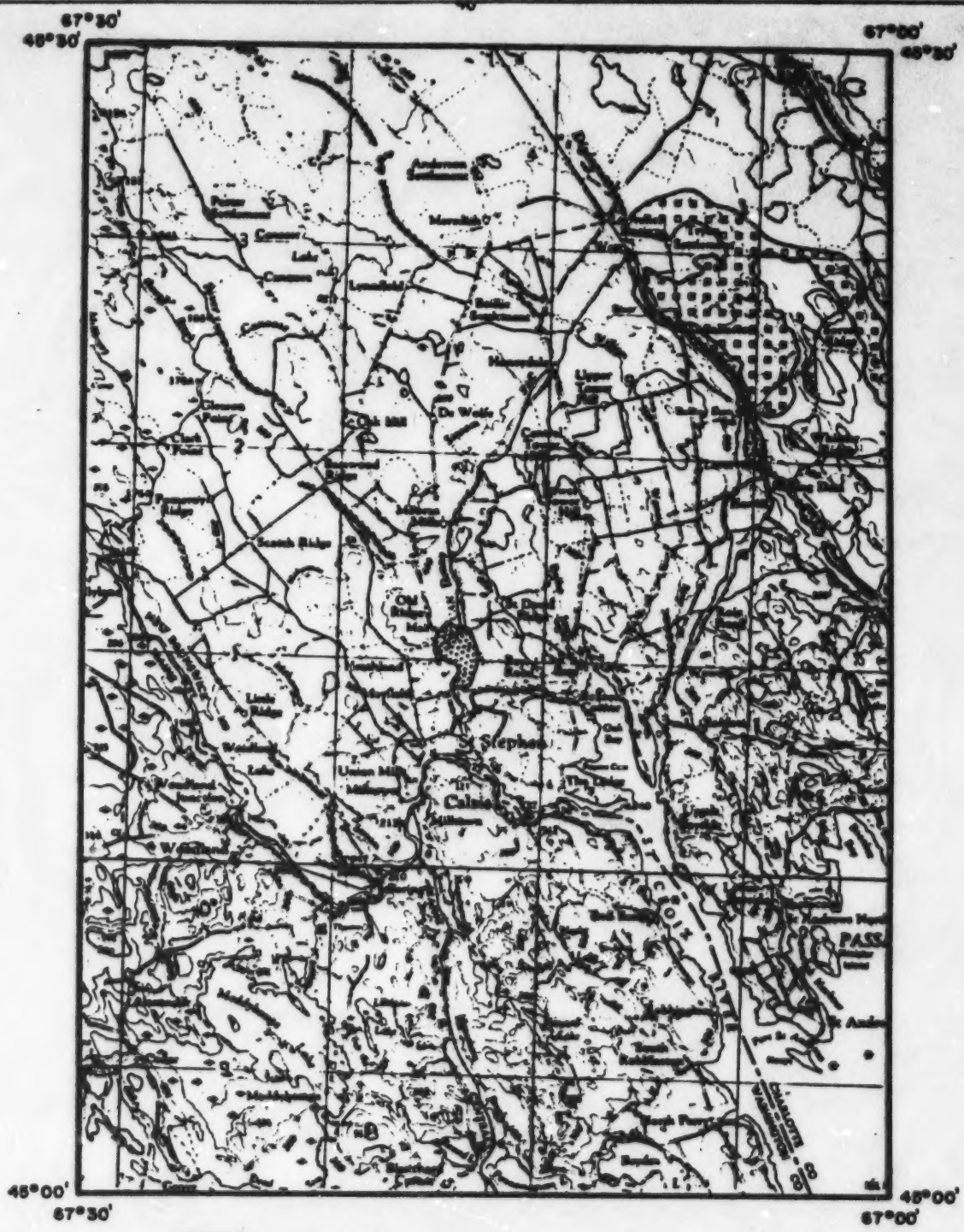


FIGURE 16.

AGGREGATE RESOURCES, ST. STEPHEN

21 G/3

1) Upper Canoose Flowage - Northwest Branch Digdeguash esker (3 million m^3 ±)
2) Basswood Ridge - Benson Corner esker (7 million m^3 ±)
3) Pomeroy Ridge - Upper Mills esker (4 million m^3 ±)

Other esker systems account for 4 million m^3 ± of granular aggregate. Esker material is variable both in texture and clast lithotypes. Eskers have extensively been used as a source for road aggregate.

Kames at Sandy Point and along the east shore of Oak Bay, northwest of St. Croix Mountain, contain approximately 1 million m^3 of material.

Glaciofluvial outwash deposits comprise the other major source of granular aggregate, especially along the Digdeguash River (8 million m^3 ±) and at Maxwell (5 million m^3 ±).

A large area of ablation till is located around Tryon Settlement, and numerous drumlin occurrences (till) have locally been used as sources of fill material.

Surficial Geology (D. Barnett)

Dr. Vern Rampton of Terrain Analysis and Mapping Services Ltd. has been engaged to produce a surficial geology map of New Brunswick at a 1:500,000 scale. Dr. Rampton recently completed the Quaternary mapping at a scale of 1:250,000 of N.T.S. sheets 21H, 21I and 21J.

The overall objective of the project is to determine the Quaternary history of New Brunswick including the sequence and chronology of ice movements, the pattern of deglaciation, the extent and nature of marine overlap and the nature of isostatic rebound.

The work will include preparation of a report including appropriate photographs and figures that will describe the Quaternary history and relate it to a map showing the Quaternary geology at a scale of 1:500,000.

Field work in 1981 was carried out in conjunction with Drs. Nelson Gadd, Vic Prest and Doug Grant together with Claude Gauthier of the G.S.C. Their experience from previous mapping in New Brunswick will be included in the final synthesis of the Quaternary history of New Brunswick.

This project is to be carried out over two years with a scheduled completion date of March 31, 1983. The first year is being funded under the Minerals and Fuels Sub-agreement and the second year under an agreement with the Geological Survey of Canada.

Gravity Survey (Satish Chandra)

Work continued on a gravity survey of selected areas of the province as a means of determining possible future areas for potash exploration.

During the 1981 field season, gravity measurements were made in the following areas:

1. Fredericton Junction (Sunbury Co.)
2. Smithtown-Salina (Kings Co.)
3. Pollett River (Westmorland and Albert Co.)
4. River Glade (Westmorland and Albert Co.)
5. Middlesex (Westmorland and Albert Co.)
6. Salisbury (Westmorland Co.)

These sites were previously covered in the 1979-1980 surveys in which anomalous gravity trends were indicated. The 1981 coverage therefore was to provide adequate data to make proper assessment of these trends. The total number of gravity stations added in the 1981 season is approximately 680. Emphasis was placed on obtaining regional coverage of areas immediate of the gravity lows and also to verify anomalous values by re-sitting of some of the 1979-1980 stations.

Assessment of data is in progress and it is anticipated that detailed gravity maps of each site will be completed by March 31, 1982.

Because of rough topography in several of these areas, terrain corrections have to be made to the Bouguer values before the data can be properly evaluated. It is hoped that the 1981 coverage will provide adequate data for geophysical modelling of each anomaly.

The ¼ mile map-areas in which additional gravity readings were made in 1981 are indicated in Figure 17.

Windsor Group Studies in the Havelock Basin (Dr. J.P.A. Noble, T. C. Webb)

The ultimate objective of this study is to provide a thorough evaluation of Windsor limestone facies throughout the Havelock area (Figure 18) in an attempt to determine the major controlling factor(s) in the distribution of high calcium limestone deposits, thereby guaranteeing efficient resource management. In addition, it is hoped that knowledge gained during this investigation may aid in the interpretation of similar

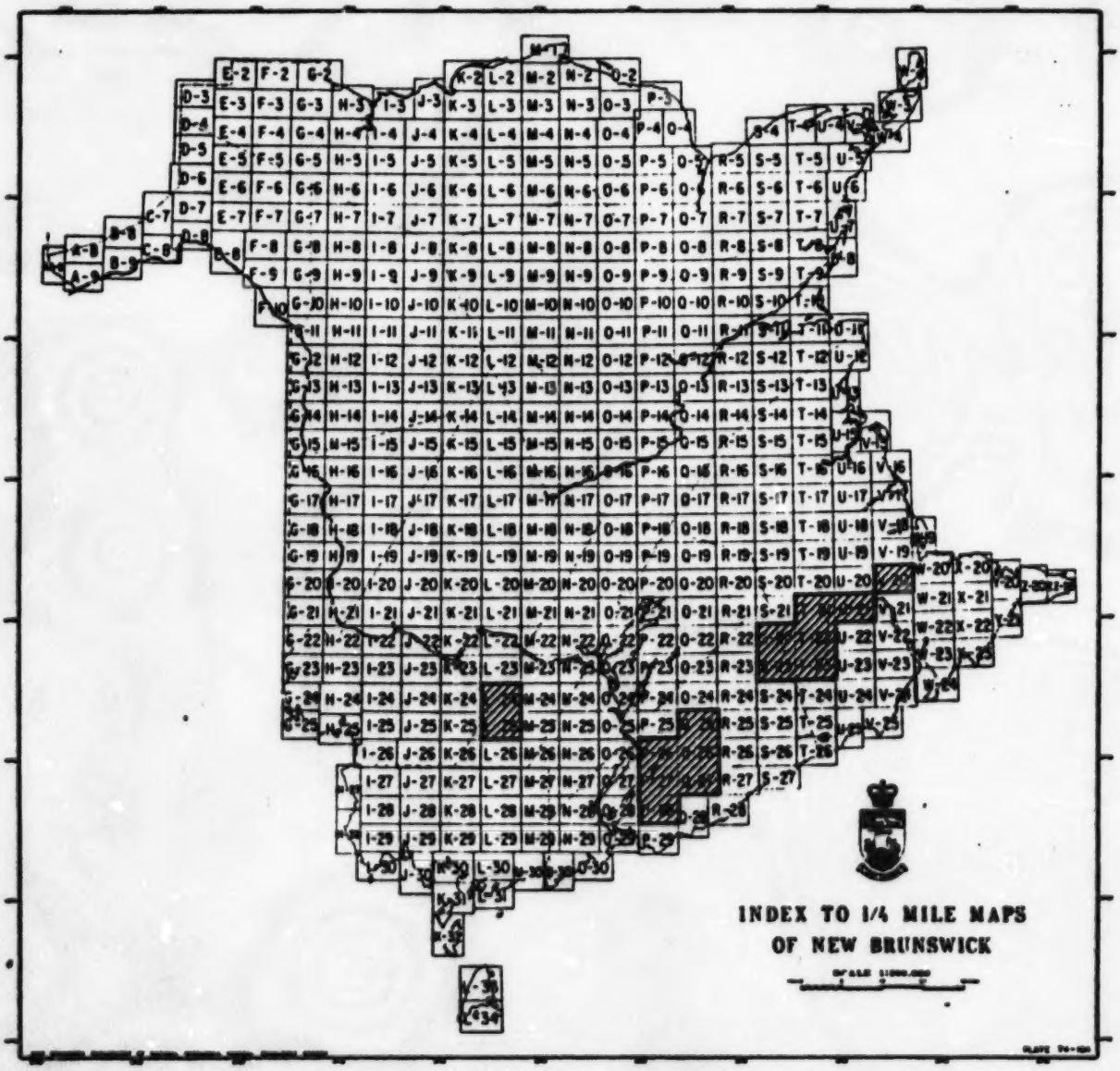


Figure 17. 1981 GRAVITY SURVEY AREAS

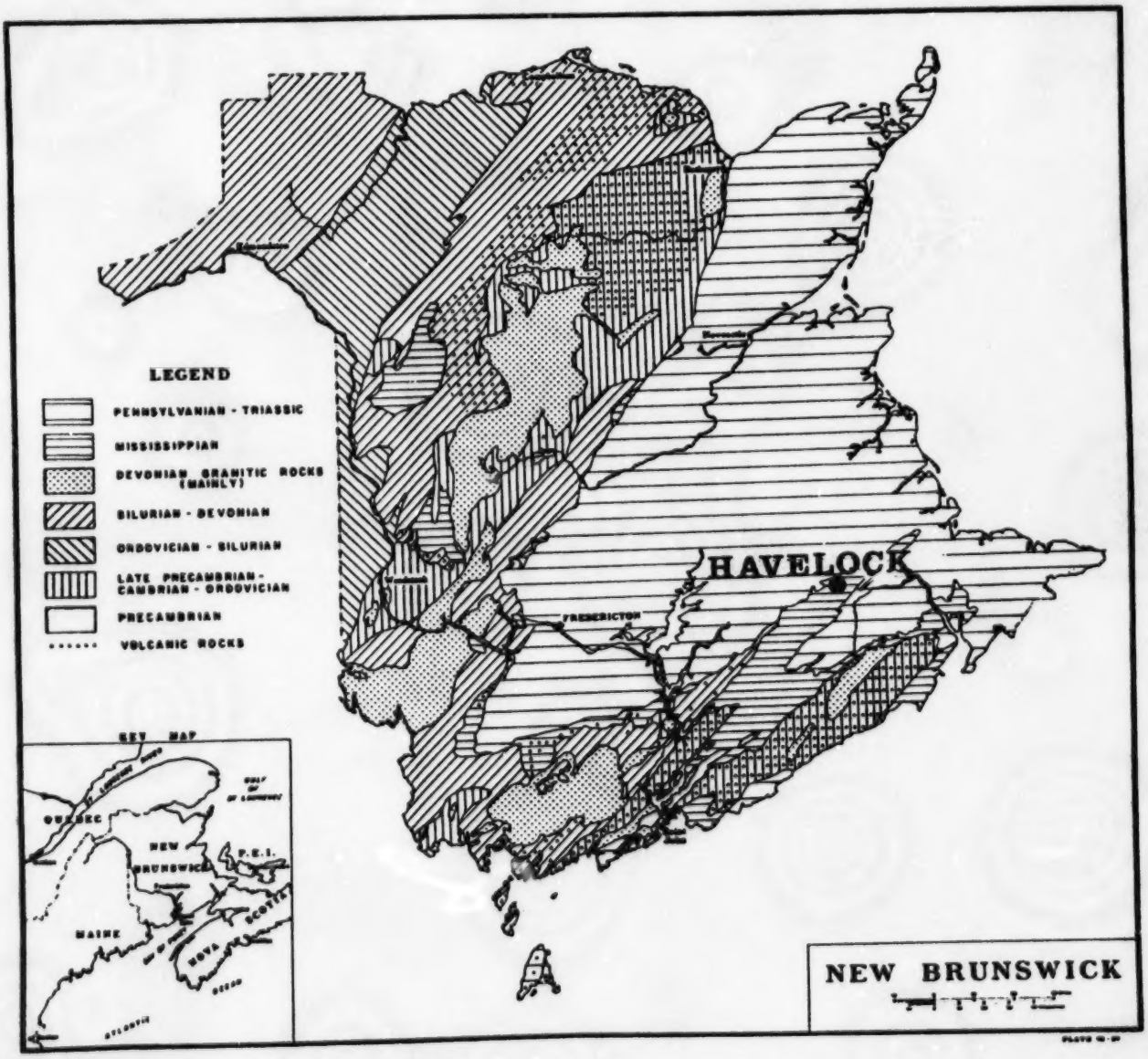


FIG. 18. LOCATION OF STUDY AREA.

Windsor strata elsewhere in New Brunswick.

Petrographic study of selected samples from detailed measured sections have made it possible to identify several distinctive lithofacies supporting a shallow-subtidal to supratidal depositional environment throughout much of the Havelock area.

A majority of the limestone facies identified are relatively pure limestone (90-99 per cent $CaCO_3$) with minor amounts of quartz, clay and mica and erratic pockets and beds of dolomite. On the basis of the above revelation, it would appear that the future development of limestone resources in the Havelock area will no doubt be largely governed by restraints to efficient quarrying practices rather than by stone of poor quality.

GEOLOGY DEPARTMENT
UNIVERSITY OF NEW BRUNSWICK

P.F. Williams, Chairman of Department

The Department has had a productive year with approximately 50 publications. Research has been financed principally by N.S.E.R.C. and there has been substantial support from A.E.C.L., the U.N.B. Research Fund, D.N.R., E.M.R., Atlantic Coast Copper Ltd., Brunswick Mining & Smelting, Consolidated Rambler Mines Ltd., Heath Steele Mines Ltd., Kerr Addison, Seabright Resources Inc. and Shell Resources Canada Ltd.

The Department presently has 30 graduate students and slighty less than half of these are working on Resources oriented projects. The principal area of research for Faculty and students continues to be the Atlantic Provinces.

The Department in Fredericton has finally vacated the old Mines Branch facilities and is now completely housed in the Geology & Forestry Building.

Two long-standing members of the Department, E.Z. Lajtai and G.E. Pajari, Jr., resigned during the year. Lajtai was replaced by J.C. White who joined us in September. In addition to teaching in the area of rock mechanics White will add to our embryonic electron microscopy group. Pajari's position has been accepted by N.J. Susak who will join us in January or as soon thereafter as he obtains his immigration papers. He is a Geochemist interested in mineralizing solutions and he will add to the strength of our economic group. We have had two Post Doctoral Fellows in the Department this year, K. Karlstrom and G. Plint. Karlstrom is presently working as a temporary Assistant Professor and filling in for Dr. Susak.

Our Geological Engineering program was finally approved a few weeks ago after some 2-3 years in the pipeline. The program already has approximately 10 students despite the fact that it has never been advertised. We expect to seek professional

accreditation next year.

The various projects in progress during the past year are listed below under discipline headings.

Regional Studies

Several members of the Department have been active in regional studies, principally in New Brunswick and Newfoundland. R.K. Pickerill in collaboration with G.E. Pajari, K.L. Currie of G.S.C. and D. Nance of Ohio University are mapping in the Saint John area (N.B.). R.H. Grant is continuing his studies of Variscan tectonics west of Saint John. P.F. Williams, K.E. Karlstrom and Ph.D. student B. van der Pluijm are carrying out mapping and a structural analysis in the Dunnage Zone around Notre Dame Bay, Newfoundland. P. Stringer and K.B.S. Burke are combining geological and geophysical mapping to trace the extent of Triassic dykes in the St. Andrews - St. George area (N.B.). G. Plint and H.W. van de Poll are mapping in detail the older Pennsylvanian Sequence between McCoy Head and Rogers Head in southern N.B.

Economic Deposits and Mineralization

The Department has been quite active in the economic field and almost half of the graduate students are working on natural resources oriented projects. A.L. McAllister's work is continuing in the Bathurst area on various aspects of ore deposit geology. One project involves a study of the extensive breccia facies of Heath Steele sulphides. A second project involving the detailed mapping of, and data compilation for, the Caribou-Restigouche belt is near completion. This is a joint project with D.N.R. The Cam Bancroft uranium study is still in progress. W.E. Hale is supervising a D.N.R. and Shell supported study of Uranium & Thorium distribution in rocks of southwest New Brunswick. He is also concerned with a classification and interpretation of mafic rocks in the Rambler deposit,

Newfoundland and a study of Nova Scotian gold occurrences including off-shore deposits. D. Bachinski is supervising a program on hydrothermal alteration in felsic rocks underlying iron-formation in the Brunswick 6 - Austin Brook area. This work demonstrates that changes in relic mineralogy of felsic units underlying iron formation are useful exploration tools in the Bathurst camp. It also provides an explanation for at least some of the potassic keratophyes in the district. Another project under Bachinski's supervision involves hydrodynamic models of fluids involved in the formation of base metal ores in sedimentary and sedimentary/volcanic basins. Work continues on deposits in the Rambler district of Newfoundland. D. Bachinski and P.F. Williams are jointly supervising the work of C. van Staal in the area of Brunswick 6 and 12 and Austin Brook. Van Staal is concerned with the deformation of the ore and the possible structural control of the ore body. H.W. van de Poll continues his interest in the economic geology of the Permo-Carboniferous of N.B. and P.E.I., with emphasis on the lithostratigraphy, sedimentology and paleoclimatic evolution of the redbeds for an overall economic evaluation of their potential with respect to gravel, (conglomerate) uranium and natural gas. R.K. Pickerill is continuing research on the oil-shale bearing Albert Formation and has recently entered into a $30,000 agreement with the D.N.R. for mapping and detailed stratigraphic and sedimentological studies with particular reference to the areal distribution of the oil shales.

Geophysics

K. Burke has been concentrating on computer processing of geophysical data. Programs have been developed to use 2½D models to interpret gravity data, error analysis of resistivity measurements and the calculation of VLF pseudo-depth sections. Burke is acting as the special editor for a monograph on

"Interactive Computer Methods of Refraction Interpretation" to be published by the Society of Exploration Geophysicists.

In other geophysical activities, preliminary tests have been made of the new offset Wenner configuration and its ability to distinguish lateral and vertical changes of resistivity in various field situations. As part of an M.Sc. project, A. Soliman is reinterpreting the Mini Sosie seismic reflection record section between Rogersville and Wayerton and also investigating the relationship between seismic velocity, density and lithology using the geophysical logs obtained during the Carboniferous Drilling Program. This M.Sc. project has financial support from the Department of Natural Resources.

Palaeontology

A. Logan (U.N.B.S.J.) and J.P.A. Noble are using diving and camera grab recording methods to study the ecology of recent brachiopod communities in the Bay of Fundy and Logan is also studying reef ecology in the Caribbean. Noble is engaged in studies of biostratigraphy and palaeoecology of Silurian corals and stromatoporoids in northern New Brunswick and Gaspé and is also studying Silurian stromatoporoids in England and Sweden. R.K. Pickerill is working on the structure, composition, ecology and evolution of Silurian brachiopod-dominated communities of Arisaig (Nova Scotia) with Dr. J.M. Hurst and on various ichnological problems in Quebec and Atlantic Canada. He is making a study of the structure, composition and evolution of Ordovician marine benthic communities in Quebec with Dr. T.L. Harland and in Wales with P.J. Brenchley. He has also recently started work on Cambrian jellyfish from the Saint John area in collaboration with Dr. Mary Wade from the Queensland Museum, Australia.

Petrology

S. Bachinski is working on the geochemistry, mineralogy and petrology of lamprophyres from New Brunswick and elsewhere and L.T. Trembath is studying crystallization of feldspar in synthetic and natural systems. This latter project is concerned with a comparison of microstructure in natural and experimentally produced, compositionally equivalent crystalline material and is aimed at developing a better understanding of the crystallization and emplacement of granitoids.

Up to the time that he left in the fall, G.E. Pajari continued supervising a study of the Rattlesnake Hills volcanic field in Wyoming in collaboration with K. Bell (Carleton University) and P. Shive (University of Wyoming).

Sedimentology

J.P.A. Noble is working on the deposition and diagenesis of Silurian sediments in northern New Brunswick and facies studies in the Carboniferous Windsor formation, especially in the Havelock region (N.B.).

R.K. Pickerill is contributing sedimentological work on the regional study of the Saint John group mentioned above.

H.W. van de Poll has expanded his Carboniferous studies to include the redbeds of Prince Edward Island and the coal measures of the Sydney Basin of Cape Breton. Mapping of Prince Edward Island has recently been completed on a 1:125,000 scale and further studies in the economic, lithostratigraphic, sedimentologic and physical diagenetic aspects of the redbeds are in progress. Studies on the coal measures of the Sydney Basin are being carried out in collaboration with Dr. D. Duff of Strathclyde University, Scotland. They are essentially sedimentological in nature with particular emphasis on physical

diagenesis of the strata. Though little studied, physical diagenesis has an important bearing on facies interpretation, basin analysis and interpretation concerning sedimentary tectonics and may also have applications in petroleum reservoir studies and metallogenesis of certain low temperature, sediment-hosted mineral deposits. Studies on physical diagenesis of clastic rocks is undertaken in cooperation with Dr. Guy Plint, Post Doctorate Fellow at U.N.B. and I. Patel of U.N.B.S.J.

Structural Geology

Up to the time of his departure E.Z. Lajtai continued his studies of fracturing in granite with a view to providing the necessary background for evaluating the risk associated with disposal of nuclear waste in granitic plutons. Together with P. Stringer he rounded off a study of jointing and joint development in sandstones in New Brunswick.

Structural mapping of the pre-Triassic rocks of Grand Manan (N.B.) by P. Stringer and G.E. Pajari is currently being published by the G.S.C. Similar work has been carried out in the Oak Bay area, St. Stephen (N.B.), by Stringer and Pajari during 1981. Investigation of folding in SW Scotland by Stringer in collaboration with Dr. J.E. Treagus has been published during 1981.

J.C. White is studying the microstructures developed in rocks during brittle and non-brittle deformation using transmission and scanning electron microscopy. Of special interest are features developed in fault zones. It is thought that these empirical observations will contribute to mechanistic descriptions of the rock behaviour.

P.F. Williams is collaborating with P. Stringer on cleavage development in the Silurian rocks of NE New Brunswick

and is analysing the structure and structural history of Palaeozoic rocks on New World Island (NFLD.). In addition to the general structural study, Williams is also working on cleavage development in the latter area and in the Carmanville area (NFLD.). He is also continuing with studies of experimentally similated foliations with a view to understanding natural foliations.